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ABSTRACT

This manual contains instructional materials which measure student performance on commercial carpentry behavioral objectives; criterion-referenced evaluation instruments are also included. Each of the manual's eleven sections consists of one or more units of instruction. Each instructional unit includes behavioral objectives, suggested activities for teachers, information sheets, job sheets, visual aids, tests, answers to the test, and transparency masters. The eleven sections (and sample units) are as follow: (1) introduction (orientation, safety and first aid); (2) leadership (parliamentary procedure and public speaking); (3) related information (lumber, measuring); (4) tools (hand and power tools); (5) blueprint reading (basic math); (6) site (builder's level and transit); (7) forming (footing and wall forms); (8) framing (trusses and wall and partition framing); (9) exterior finish (plywood siding and trim); (10) interior wall finish (dry wall); and (11) interior trim (stair construction, paneling). A discussion on how to use each area of an instructional unit is also included. (CT)

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COMMERCIAL CARPENTRY

Instructional Units

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1974

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Developed as a cooperative project by the
Associated General Contractors of America,
Thomas P. Ryan, Chairman, Manpower and Training Committee

and

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Revised edition

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FOREWORD

In 1972, the Associated General Contractors of America met with representatives of the Oklahoma Curriculum and Instructional Materials Center to discuss the possibility of developing, as a cooperative project, a course of instruction that would be especially designed for training the carpenter who will make her/his career in industrial and commercial construction.

This publication is the result of those original discussions. It is the product of close coordination between general contractors, people who actually work in construction, and vocational-technical educators. It represents a conscious effort to meld the practical experience of personnel from the world of construction with the best instructional methods available from the world of education.

The trainers of construction workers are faced with the challenge of providing thorough and modern training to the backbone of the building industry - its workforce. The purpose of this manual is to assist carpentry teachers in providing a uniformly high caliber of thorough instruction to their students. This publication should be supplemented by each instructor's own methods and materials. The information in the manual may be adapted to coincide with local conditions that dictate modification in content or method.

Dr. Francis T. Tuttle, Director
Oklahoma State Department of
Vocational and Technical Education

Thomas P. Ryan, Chairman
Manpower and Training Committee
Associated General Contractors of America

PREFACE

For many years contractors and those responsible for training commercial carpenters have felt the need for instructional materials to be used in training the carpenter. In 1974, the Associated General Contractors of America, with the cooperation and support of the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, accepted the challenge to produce a manual for use in training the commerical carpenter in those areas in which she or he is expected to be proficient. In 1978, AGC and the CIMC decided that there was a need to update this manual in order to keep up with the ever-changing materials, skills, and demands of the profession. Therefore, we have revised this manual, with these changes in mind.

Instructional material in this manual is written in terms of student performance using measurable behavioral objectives. This is an innovative approach to teaching which accents and augments the teaching-learning process. Criterion-referenced evaluation instruments provide for a uniform measurement of student progress.

Commercial carpentry instructors are faced with the challenge of providing students with the skill and related information necessary to meet the demands of a changing profession. Competition for jobs is greater than ever. Therefore, the commercial carpenter must be better trained and better equipped to find and retain meaningful employment.

The purpose of this manual is to assist commercial carpentry instructors in providing instruction throughout the industry. This publication should be supplemented by each instructor's methods and materials. Any information in this manual that does not concur with the instructor's course of study can very easily be modified to meet personal needs.

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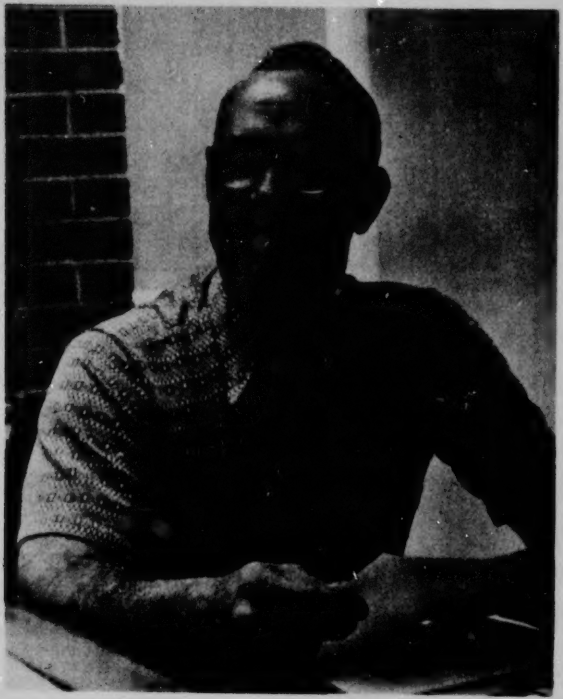

Bud Hendrix was born in 1923 in Indianapolis, Indiana. He started his training by working with his father, a cement mason, during school vacations his junior and senior years of high school. Bud's formal education ended with the completion of high school.

In 1942, Bud joined the Cement Mason's International Association of the United States and Canada, Local Union #532, in Indianapolis, Indiana. Bud's term as a cement mason was short-lived when he had to take a leave of absence to join the armed forces in early 1943. He spent thirty-seven months in the Navy and then returned to Indianapolis and Local #532 to complete his three years of apprenticeship. At that time, Bud was employed by A. V. Stackhouse Construction Company. He stayed with this firm until late 1948, when he went to work for Wilhelm Construction for whom he worked until he joined the George Bahre Company in the spring of 1949. He remained with George Bahre for the next twenty-six years. Bud was classified as concrete superintendent, a position he earned after working at the trade for many years. He held several positions as an officer in the Local over the years and instructed journeymen and apprentices in two upgrading classes.

In 1974, Bud developed the *Cement Mason's Curriculum*. For the development of this manual, his thirty-three years of experience were loaned to the Associated General Contractors of America. During this period, he served as a member of the staff of the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center. After completion of this manual, Bud returned to Indianapolis and started his own general contracting company. Then, in 1976, Bud again returned to Oklahoma to develop the *Construction Craftsman's Curriculum*. Before completing this manual he was asked to revise *Commercial Carpentry*, so he remained as a staff member of the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center to complete this revision.

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USE OF THIS PUBLICATION

Instructional Units

Commercial Carpentry includes eleven sections. Each section consists of one or more units of instruction. Each instructional unit includes behavioral objectives, suggested activities for teacher, information sheets, assignment sheets, job sheets, visual aids, tests, and answers to the test. Units are planned for more than one lesson or class period of instruction.

Careful study of each instructional unit by the teacher will help him/her determine:

A. The amount of materials that can be covered in each class period.
B. The skills which must be demonstrated.
    1. Supplies needed
    2. Equipment needed
    3. Amount of practice needed
    4. Amount of class time needed for demonstrations
C. Supplementary materials, such as pamphlets and filmstrips, that must be ordered.
D. Resource people who must be contacted.

Objectives

Each unit of instruction is based on behavioral objectives. These objectives state the goals of the course, thus providing a sense of direction and accomplishment for the student.

Behavioral objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction, and specific objectives, stating the student performance necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms which were used in this material:

Name
- Label
- List in writing
- List orally
- Letter
- Record
- Repeat
- Give

Identify
- Select
- Mark
- Point out
- Pick out
- Choose
- Locate

Describe
- Define
- Discuss in writing
- Discuss orally
- Interpret
- Tell how
- Tell what
- Explain

Order
- Arrange
- Sequence
- List in order
- Classify
- Divide
- Isolate
- Sort

Distinguish
- Discriminate

Construct
- Draw
- Make
- Build
- Design
- Formulate
- Reproduce
- Transcribe
- Reduce
- Increase

Demonstrate
- Show your work
- Show procedure
- Perform an experiment
- Perform the steps
- Operate
- Remove
- Replace
- Turn off/on
- (Dis) assemble
- (Dis) connect

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Teachers should feel free to add objectives which will fit the materials to the needs of the students' and community. When a teacher adds objectives, he/she should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. Duties of the instructor will vary according to the particular unit. However, for best use of the materials they should include the following: provide student with objective sheet, information sheet, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss unit and specific objectives and information sheet; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Information Sheet

The information sheet provides content essential for meeting the cognitive (knowledge) objectives of the unit. The teacher will find that the information sheet serves as an excellent guide for presenting the background knowledge necessary to develop the skills specified in the unit objective.

Students should read the information sheet before the information is discussed in class. Students may take additional notes on the information sheet.

Transparency Masters

Transparancey masters provide information in a special way. The students may see as well as hear the materials being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets. They are particularly effective for such activities as learning and locating the parts of a machine.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the teacher to speak too loudly.)

Job Sheets

Job sheets are an important segment of each unit. The instructor should be able and in most situations should demonstrate the skills outlined in the job sheets. Procedures outlined in the job sheets give direction to the skill being taught and allow both student and teacher to check student progress toward the accomplishment of the skill. Job sheets provide a ready outline for a student to follow if he/she has missed a demonstration. Job sheets also furnish potential employers with a picture of the skills being taught and the performances that might reasonably be expected from a person who has had this training.

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledges which are necessary prerequisites to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and will help the teacher spot difficulties being encountered by students in their efforts to accomplish the unit objective. Test items for objectives added by the teacher should be constructed and added to the test. Progress sheets are provided for the teacher to record acceptable performance of skills outlined in job sheets.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

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[redacted]

SECTION A

Introduction

ORIENTATION
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to name places of employment and list facts concerning the occupational outlook for carpenters. The student should be able to list student requirements and name major skills involved in carpentry. The student should complete a personal information sheet. This knowledge will be evidenced through completion of the assignment sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. List facts concerning the occupational outlook for carpenters.
2. Name employment opportunities for carpenters.
3. List student requirements for the carpentry program.
4. Name major skills involved in carpentry.
5. Complete a personal information sheet.

ORIENTATION
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide student with objective sheet.

  B. Provide student with information and assignment sheets.

  C. Discuss unit and specific objectives.

  D. Discuss information and assignment sheets.

  E. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Assignment Sheet #1--Complete Personal Information Sheet

  D. Test

  E. Answers to test

III. Unit reference--*Occupational Outlook Handbook.* 1970-71 edition. U. S. Department of Labor, Bureau of Labor Statistics, Bulletin No. 1650.

ORIENTATION
UNIT I

INFORMATION SHEET

I. Occupational outlook

  A. Job opportunities result each year from the need to replace experienced carpenters who retire or die

  B. Number of new houses being constructed each year requires more carpenters to construct and maintain them

  C. Specialization has created more job opportunities and more desirable working conditions

II. Employment opportunities

  A. Independent and union-affiliated residential building contractors

  B. Independent and union-affiliated commercial contractors

  C. Building maintenance for large office buildings or corporations

  D. Pre-fab shops

  E. Lumber yards

III. Student requirements for the carpentry program

  A. Operate all power tools correctly

  B. Be safety conscious and follow safety regulations

  C. Take instructions readily and follow directions

  D. Be a good citizen

  E. Control temper at all times

  F. Display enthusiasm about work

  G. Exhibit pride in the carpentry trade

  H. Practice conservation of materials and work-hours

  I. Be punctual

INFORMATION SHEET

IV. Major skills involved in carpentry

- A. Blueprint reading
- B. Measuring
- C. Using hand tools
- D. Using power tools
- E. Making material estimates
- F. Erecting a building

ORIENTATION
UNIT I

ASSIGNMENT SHEET #1--COMPLETE PERSONAL INFORMATION SHEET

Complete the following personal information sheet and hand in to instructor.

NAME ______________________ CLASS ________________

HOME ADDRESS ________________________________

HOME PHONE __________________________________

PARENTS' (GUARDIANS') NAMES ______________________

PARENTS' OCCUPATIONS ____________________________

____

PARENTS' BUSINESS PHONES _________________________

____

WHERE CAN YOUR PARENTS BE REACHED IN CASE OF AN EMERGENCY? ______

____

FAMILY DOCTOR _________________________________

SHOP COURSES YOU HAVE HAD ________________________

____

TRADE EXPERIENCE ______________________________

____

NAME OF INSURANCE COMPANY ______________________

____

ORIENTATION
UNIT I

TEST

NAME ______________________ SCORE __________

1. List the facts concerning the occupational outlook for carpenters.

   a. ______________________

   b. ______________________

   c. ______________________

2. Name three employment opportunities for carpenters.

   a. ______________________

   b. ______________________

   c. ______________________

3. List six student requirements for the carpentry program.

   a. ______________________

   b. ______________________

   c. ______________________

   d. ______________________

   e. ______________________

   f. ______________________

4. Name the major skills involved in carpentry.

   a. ______________________

   b. ______________________

   c. ______________________

   d. ______________________

   e. ______________________

   f. ______________________

5. Complete a personal information sheet.

(NOTE: If the above activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

ORIENTATION
UNIT I

ANSWERS TO TEST

1. a. Job opportunities result each year from the need to replace experienced carpenters who retire or die

   b. Number of new houses being constructed each year requires more carpenters to construct and maintain them

   c. Specialization has created more job opportunities and more desirable working conditions

2. Any three of the following:

   a. Independent and union-affiliated residential building contractors

   b. Independent and union-affiliated commercial contractors

   c. Building maintenance for large office buildings or corporations

   d. Pre-fab shops

   e. Lumber yards

3. Any six of the following:

   a. Operate all power tools correctly

   b. Be safety conscious and follow safety regulations

   c. Take instructions readily and follow directions

   d. Be a good citizen

   e. Control temper at all times

   f. Display enthusiasm about work

   g. Exhibit pride in the carpentry trade

   h. Practice conservation of materials and work-hours

   i. Be punctual

4. a. Blueprint reading

   b. Measuring

   c. Using hand tools

- d. Using power tools
- e. Making material estimates
- f. Erecting a building

5. Evaluated to the satisfaction of the instructor

FREE ENTERPRISE SYSTEM
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to describe areas of government involvement in the marketplace. The student should also be able to discuss the free enterprise system, discuss problems with government involvement, and select from a list ways prices influence the economy. This knowledge will be evidenced by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with the free enterprise system to the correct definitions.
2. List resources necessary for production of goods and services.
3. Match economic goals of American people to statements describing the goals.
4. List the roles of the government in the economy.
5. Discuss in a short paragraph roles of individuals and businesses in the economy.
6. Describe the function of supply and demand schedules.
7. List the factors that determine the degree of elasticity of demand.
8. Select from a list the ways prices influence the economy.
9. List the benefits of competition and profit.
10. Discuss the characteristics of our modified free enterprise system.
11. Describe ways the government has become involved in the marketplace.
12. List reasons that the government's role has increased.
13. Discuss problems with government involvement in the economy.
14. Select from a list the reasons for striving to reach economic goals.

FREE ENTERPRISE SYSTEM
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide student with objective sheet.

   B. Provide student with information sheet.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   (NOTE: The instructor may want to bring in a resource person to assist with this unit. Provide the person with a copy of the unit.)

   F. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Circular Flow Between Producers and the Public

      2. TM 2--Comparative Standard of Living

      3. TM 3--Alternate Uses for Scarce Land

      4. TM 4--Alternate Uses for Scarce Capital

      5. TM 5--Alternate Uses for Scarce Workforce

      6. TM 6--Desire for Stability vs Desire for Freedom

      7. TM 7--Desire for Security vs Desire for Efficiency

      8. TM 8--Desire for Growth vs Desire for Justice

      9. TM 9--Circular Flow Between Government and the Public

      10. TM 10--Supply and Demand Schedule

      11. TM 11--Supply and Demand Curves

12. TM 12--Ways Prices Influence the Economy
13. TM 13--Helping Growth
14. TM 14--Limiting Growth

D. Test

E. Answers to test

III. Unit references:

A. Calderwood, James D., and Fersh, George L. *Economics for Decision-Making.* New York: Macmillan Publishing Co., Inc., 1974.

B. Nelson, Frank W. *Distributive Education II: Course of Study.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1976.

C. Turcotte, Raymond J., and Patton, Bob. *Bricklaying Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1977.

FREE ENTERPRISE SYSTEM
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Economics--Study of how persons can best consume, produce, and distribute goods and services to try to satisfy their never-ending and ever-increasing wants

B. Free enterprise--System where most production is done by privately owned corporations, partnerships, and private citizens in a free market

(NOTE: Free enterprise is sometimes referred to as *private enterprise*.)

C. Demand--Amount of a good or service wanted at a given price and time

D. Supply--Amount of a good or service that will be offered for sale at a given price and time

E. Elasticity--How much the demand for a good or service will increase if the price is lowered or how much the demand will decrease if the price is raised

Example: If the price of cars were cut by 50%, the demand probably would increase greatly

F. Inelasticity--Condition where demand is not affected much by a change in price

Example: If the price of salt were cut by 50%, the demand would not increase very much

G. Product market--System where goods and service are sold by producers to consumers who in turn pay money to the producers for these goods and services (Transparency 1)

H. Factor market--System where the factors of production (labor, management, property, and savings) flow from the public to the producers and where money payments (wages, salaries, interest, rent, and dividends) flow from the producers back to the public (Transparency 1)

I. Communism--Economic and political system where the government leaders try to achieve equality by controlling *all* property and production and by deciding how and to whom goods and services are distributed

Examples: USSR, China

INFORMATION SHEET

J. Capitalism--Economic and political system characterized by elected representatives, *limited* government control, and freedoms such as freedom of speech, the right to own property, the right to choose a job, and freedom of religion (Transparency 2)

(NOTE: The term *capitalism* is often used interchangeably with the term *free enterprise* or *private enterprise*.)

K. Socialism--Economic and political system where the government controls *most* means of production

Example: Great Britain

L. Assets--Property owned by or due a business

Examples: Cash, accounts receivable, inventory, building, patents

M. Liabilities--All claims against a corporation or entity

Examples: Salaries, dividends, taxes, mortgages, loans

N. Natural resources--Materials supplied by nature

Examples: Land, water, lumber, minerals, fuel

O. Labor--Services performed by people with skills for wages

P. Capital--Accumulated goods designed to bring in income

Examples: Tools, machines, buildings

Q. Management--Skill to direct and control other resources

R. Technology--Ability to produce more goods and services with fewer resources

S. Entrepreneur--Person who organizes and manages a business, assuming the risk for the sake of profit

II. Resources necessary for production of goods and services (Transparencies 3, 4, and 5)

A. Capital

B. Management

C. Labor

D. Natural resources

INFORMATION SHEET

III. Economic goals of American people (Transparencies 6, 7, and 8)

A. Economic efficiency--Getting the most of time, energy, money, and abilities

B. Economic growth--Obtaining better education, highways, hospitals, postal service, fire and police protection, and recreational facilities for all Americans

C. Economic stability--Avoiding recessions, depressions, and inflation

D. Economic security--Protecting against risks people run into in their daily lives

E. Economic freedom--Going into business to produce whatever goods and services a person thinks he/she can sell at a profit

(NOTE: This also includes the freedom to leave a business.)

F. Economic justice--Applying economic policies to the ideas about what is right and wrong

Examples: Minimum wage laws; individuals being financially able to support churches and other charitable organizations

(NOTE: Goals may conflict. Therefore, Americans must try to achieve the best combination or "mix" of these goals. It is the privilege and responsibility of all Americans to know the issues, vote on bills, and elect officials at all levels of government who will help achieve these goals.)

IV. Roles of the government in the economy (Transparency 9)

A. Producer and consumer

(NOTE: Federal, state, and local governments are the biggest businesses in the country.)

Examples: Government hires workers, buys raw materials, produces postal services, establishes universities, runs hospitals, provides police and fire protection, and collects taxes to pay for the production costs

B. Regulator and protector

(NOTE: The government in this role sets rules for banks and advertising; pollution controls, building codes; food, drug, and cosmetic standards; and utility rates and enforces wage and age requirements for employment.)

C. Promoter of economic goals of American people

INFORMATION SHEET

V. Role of individuals and businesses in the economy (Transparency 1)

  A. Individuals and businesses save money

  B. Savings are then invested in machines, tools, factories, stores, and offices

  C. Labor works to produce goods and services for itself and others

  D. Businesses provide wages, salaries, and stock dividends with which individuals can save and/or purchase goods and services

VI. Function of supply and demand schedules--To determine price and quantity of good or service (Transparencies 10 and 11)

(NOTE: Demand and supply are the totals of individual decisions of millions of buyers and sellers.)

VII. Factors that determine the degree of elasticity of demand (Transparencies 10 and 11)

  A. Whether a good or service is a necessity or luxury

  (NOTE: Luxuries are more elastic than necessities. Thus, more luxury items would usually be demanded at lower prices.)

  B. Availability and price of substitute products

  Example: Oleo may be substituted for butter. If the price of butter goes down, people might buy more butter and less oleo

  C. Amount of money people are willing and able to spend

VIII. Ways prices influence the economy (Transparency 12)

  A. Prices determine what will be produced by showing what is profitable and not profitable to sell

  B. Prices determine how scarce resources will be used

  C. Prices determine whether a substitute can be used

  Example: If the consumers have no preference, an item made from plastic can be substituted for one made from glass in order to reduce the cost of production

  D. Prices determine who can afford certain goods and services

  E. Individual decisions are influenced by prices

  Example: Price changes influence buying and selling habits and occupational decisions

INFORMATION SHEET

F. People collectively determine prices by what they are willing to buy

(NOTE: This is known as *economic vote*.)

G. Producers try to learn how consumers will "vote" or purchase goods and services by studying past sales records and by conducting marketing studies

IX. Benefits of competition and profit

A. Stimulates the development of new or improved goods and services

B. Causes scarce resources to be used as efficiently as possible

C. Reduces prices

D. Motivates people to open new businesses

E. Creates new jobs

(NOTE: No profit = No capital = No tools = No jobs.)

F. Encourages more effective selling and promotion techniques

(NOTE: The *average net profit*, after taxes, in retailing is four percent or four cents out of every dollar of *sales*. The *average return on investment* for all industries is about eleven percent. Profits may be used to invest in new equipment, pay dividends, conduct research, and support educational and charitable organizations.)

X. Characteristics of our modified free enterprise system

A. Permits local, state, and federal governments to play a role in how resources will be used

B. Allows some monopolies to exist

Example: Telephone companies

C. Has profit motive as main incentive

D. Maintains efficiency through competition in the marketplace

E. Determines kinds and levels of production mainly by consumer purchases

F. Provides rights to own property, to enter or leave a job, and to make contracts

INFORMATION SHEET

XI. Ways the government has become involved in the marketplace

   A. Floor (minimum) and ceiling (maximum) boundaries set on wages and prices

   (NOTE: Boundaries may affect unemployment.)

   B. Regulations on public utilities

   Examples: Airlines, railroads, telephone companies, and gas and electricity rates

   C. Tariffs on imports to encourage the sale of American goods

XII. Reasons government's role has increased

   A. Larger populations and movement to large cities require more goods and services

   Examples: Sewers, street lights, garbage trucks, health regulations

   (NOTE: Such services are often necessary before industry will locate in a city.)

   B. Need for national defense has increased

   C. Desire for justice

   D. Desire for economic security

XIII. Problems with government involvement in the economy

   A. Government is not as efficient as private business

      1. Government agencies do not have to use resources wisely in order to make profit or to compete

      2. Civil service safeguards lessen the influence of politics on government employees but may make it difficult to fire the people who may not do a job well

   B. People often lose certain freedoms of choice

XIV. Reasons for striving to reach economic goals (Transparencies 13 and 14)

   A. Raise the standard of living for more people

   B. Have full employment

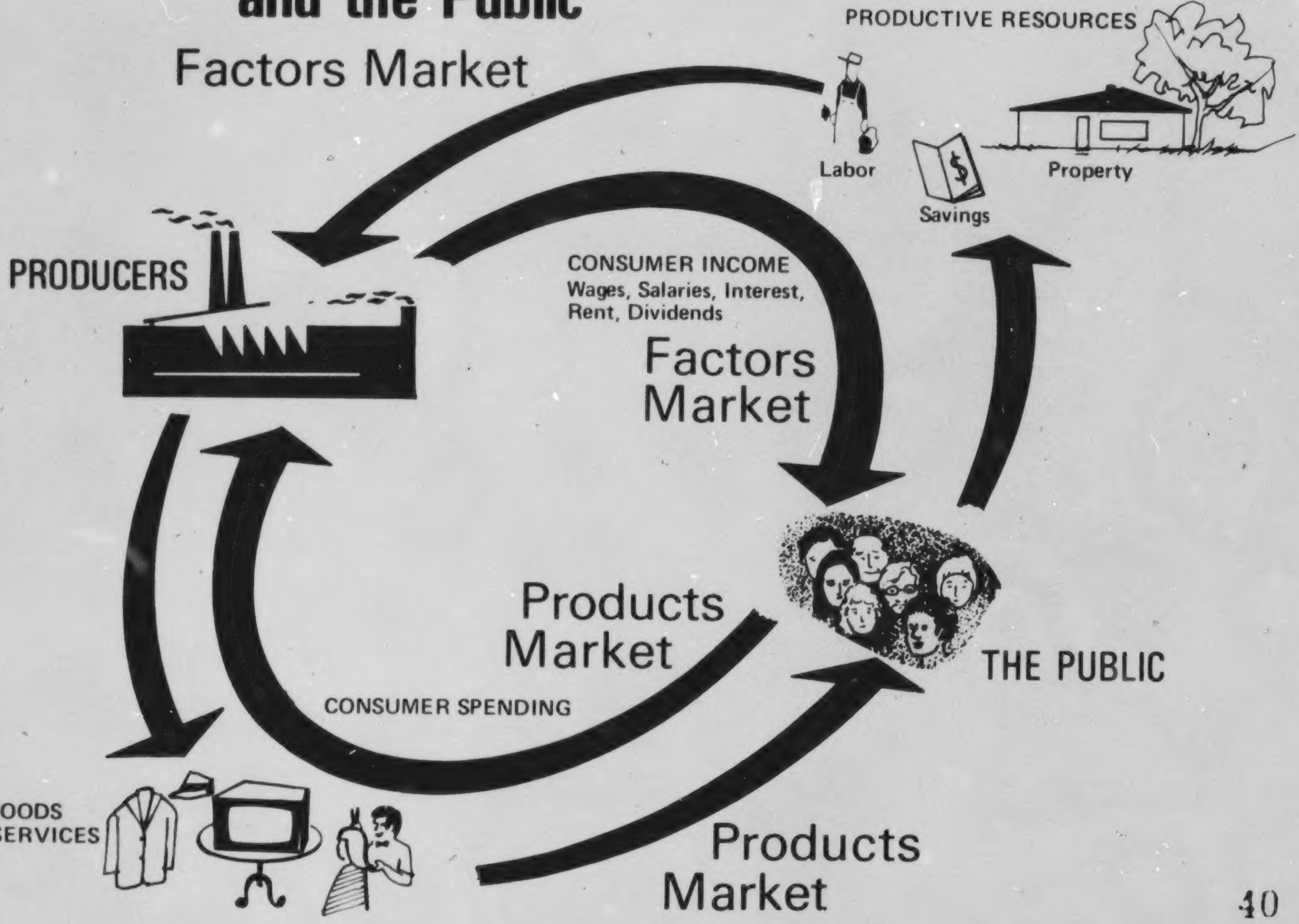
   C. Compete in the international market with countries such as Japan and Germany

INFORMATION SHEET

D. Meet the challenge of communism to replace the United States as the world's leading power

E. Provide assistance and guidance to developing countries

Circular Flow Between Producers and the Public



Factors Market

PRODUCTIVE RESOURCES

Labor

Savings

Property

PRODUCERS

CONSUMER INCOME
Wages, Salaries, Interest, Rent, Dividends

Factors Market

Products Market

CONSUMER SPENDING

THE PUBLIC

GOODS AND SERVICES

Products Market

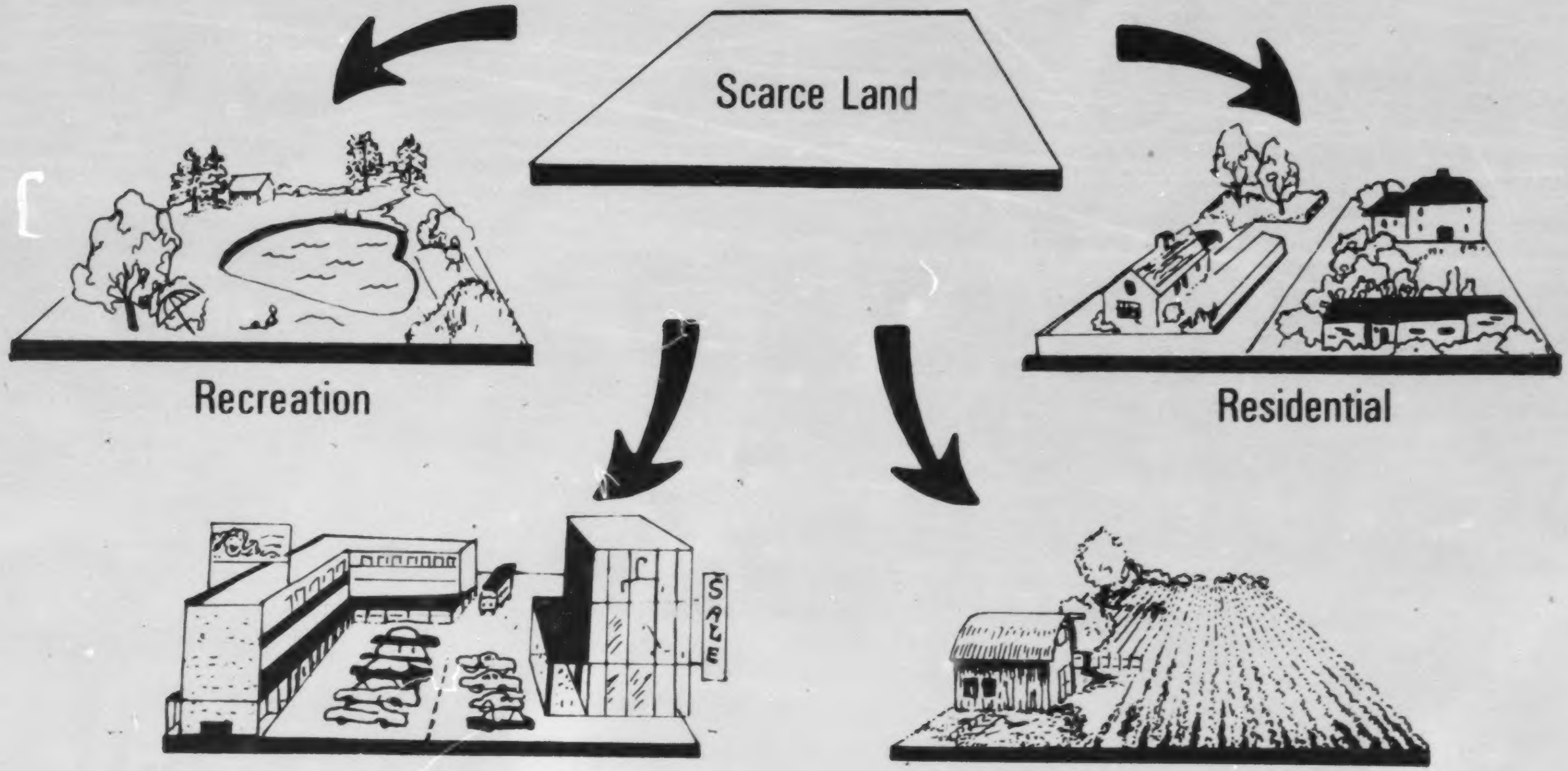
Comparative Standard of Living

Approximate worktime required for average manufacturing employee to buy selected commodities in retail stores in Washington, D.C. and London and at state-fixed prices in Moscow during May 1976:

COMMODITY	WASHINGTON, D.C.	LONDON	MOSCOW
Milk (1 liter)	7 minutes	11 minutes	21 minutes
Hamburger meat, beef (1 kg)	34 minutes	76 minutes	3.5 hours
Sausages, pork (1 kg)	71 minutes	60 minutes	2.6 hours
Potatoes (1 kg)	8 minutes	23 minutes	(7) minutes
Apples, eating (1 kg)	16 minutes	24 minutes	5.4 hours
Sugar (1 kg)	9 minutes	15 minutes	65 minutes
White bread (1 kg)	21 minutes	10 minutes	20 minutes
Eggs (10)	10 minutes	13 minutes	97 minutes
Vodka (0.7 liters)	67 minutes	3.4 hours	9.8 hours
Cigarettes (20)	10 minutes	27 minutes	23 minutes
Weekly food basket for four people	17.2 hours	28.2 hours	64.6 hours
Soap, toilet (150 grams)	5 minutes	10 minutes	72 minutes
Lipstick	31 minutes	54 minutes	7.8 hours
Panty hose	17 minutes	15 minutes	9 hours
Men's shoes (black, leather)	6.7 hours	7.7 hours	36 hours
Man's business suit	25 hours	40 hours	106 hours
Refrigerator, small (150 liters)	47 hours	50 hours	168 hours
Color TV set, large (59 cm screen)	3.9 weeks	5.5 weeks	19.5 weeks
Small Car (Fiat or Zhiguli)	6.9 months	11.1 months	3.1 years

Provided by Phillips Petroleum Company in cooperation with the National Federation of Independent Business.

Alternate Uses for Scarce Land



Scarce Land

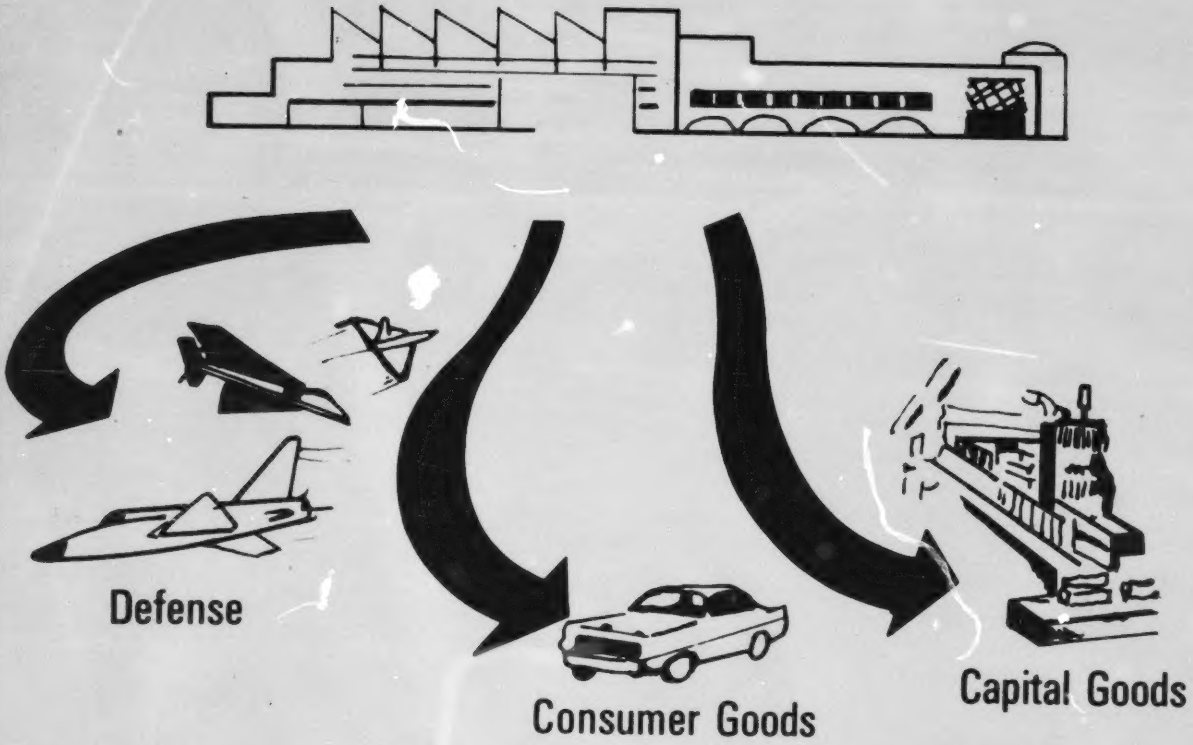
Recreation

Residential

Business

Agriculture

Alternate Uses for Scarce Capital

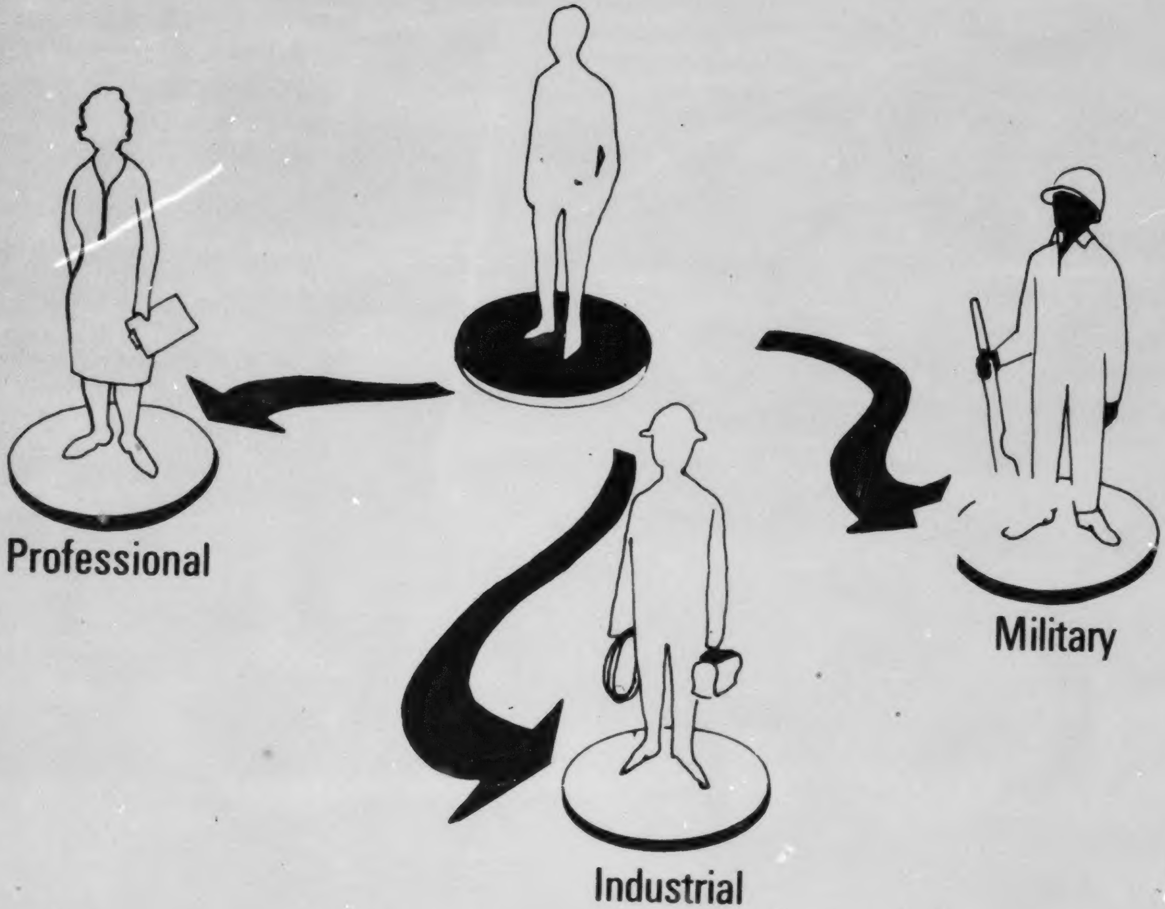


Defense

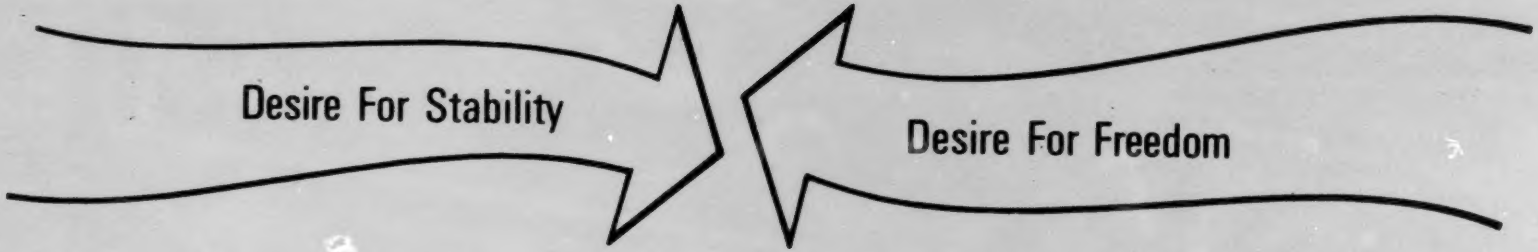
Consumer Goods

Capital Goods

Alternate Uses for Scarce Workforce


Professional
Military
Industrial

Desire for Stability vs Desire for Freedom

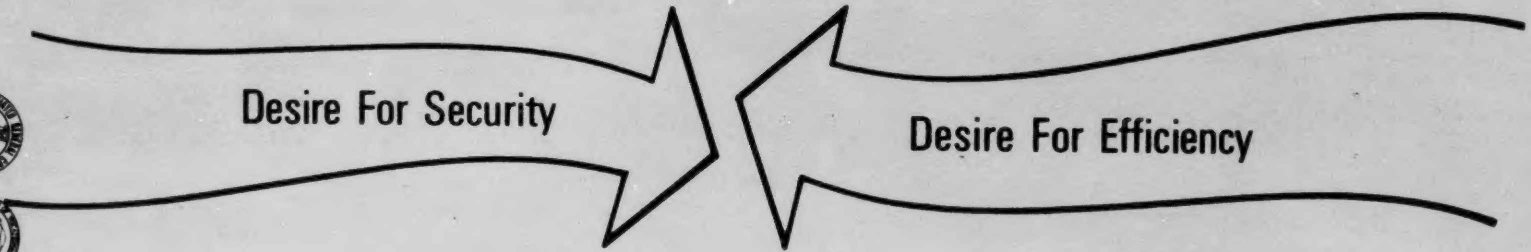


Desire For Stability

Desire For Freedom

Wage and price controls
to prevent
inflation . . . . may conflict with . . . Free decision-making
in the market by worker,
businessperson, and
consumer

Desire for Security vs Desire for Efficiency



Desire For Security

Desire For Efficiency

A tariff on foreign goods entering the U.S. to protect domestic producers . . . . may conflict with . . . free trade which leads to more effective use of productive resources and gives consumers lower prices

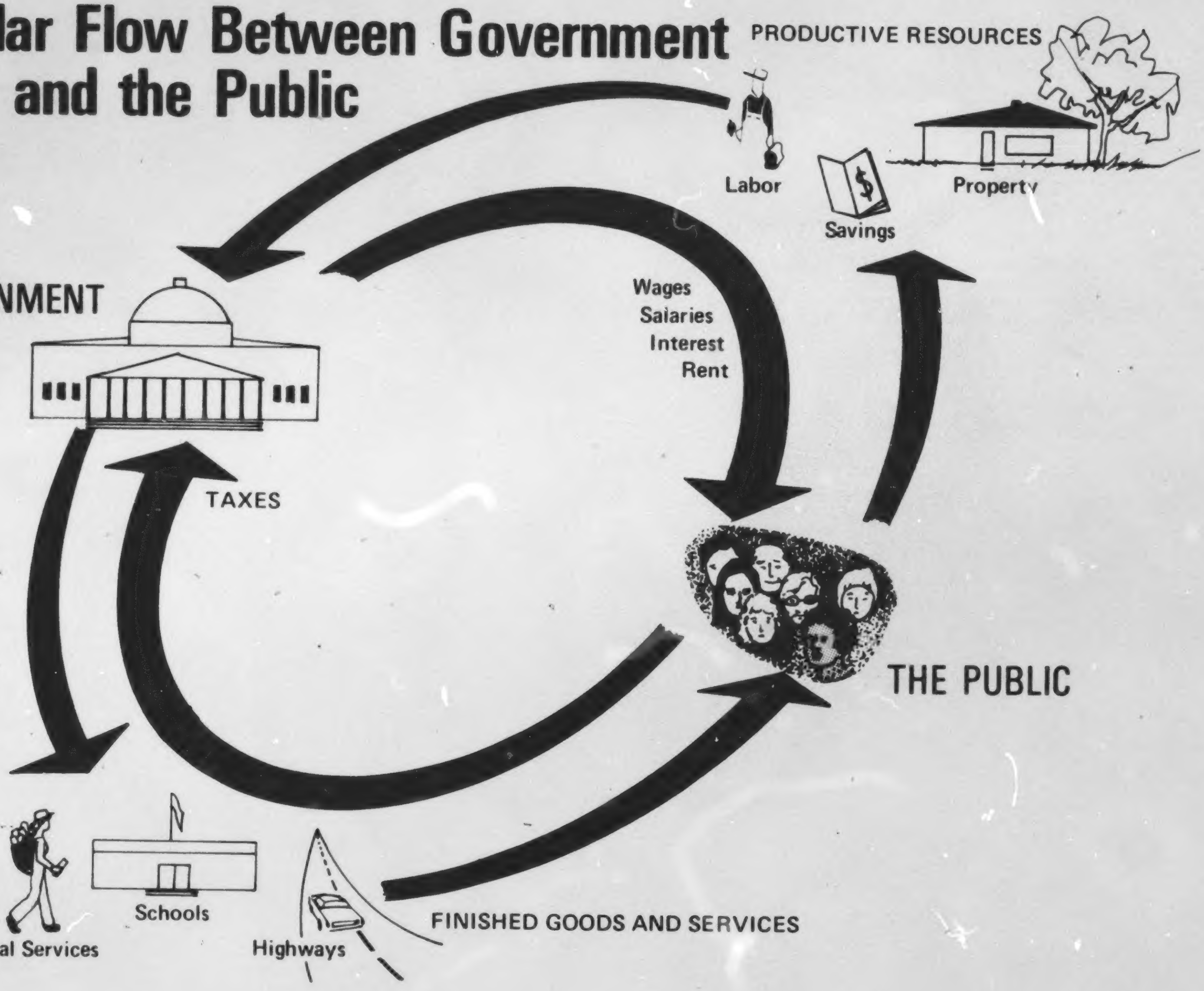
Desire for Growth vs Desire for Justice

Desire For Growth

Desire For Justice

Building interstate highways around cities to improve transportation . . . may conflict with . . . Business interests of motels, gas stations, and restaurants on old road through city

Circular Flow Between Government and the Public

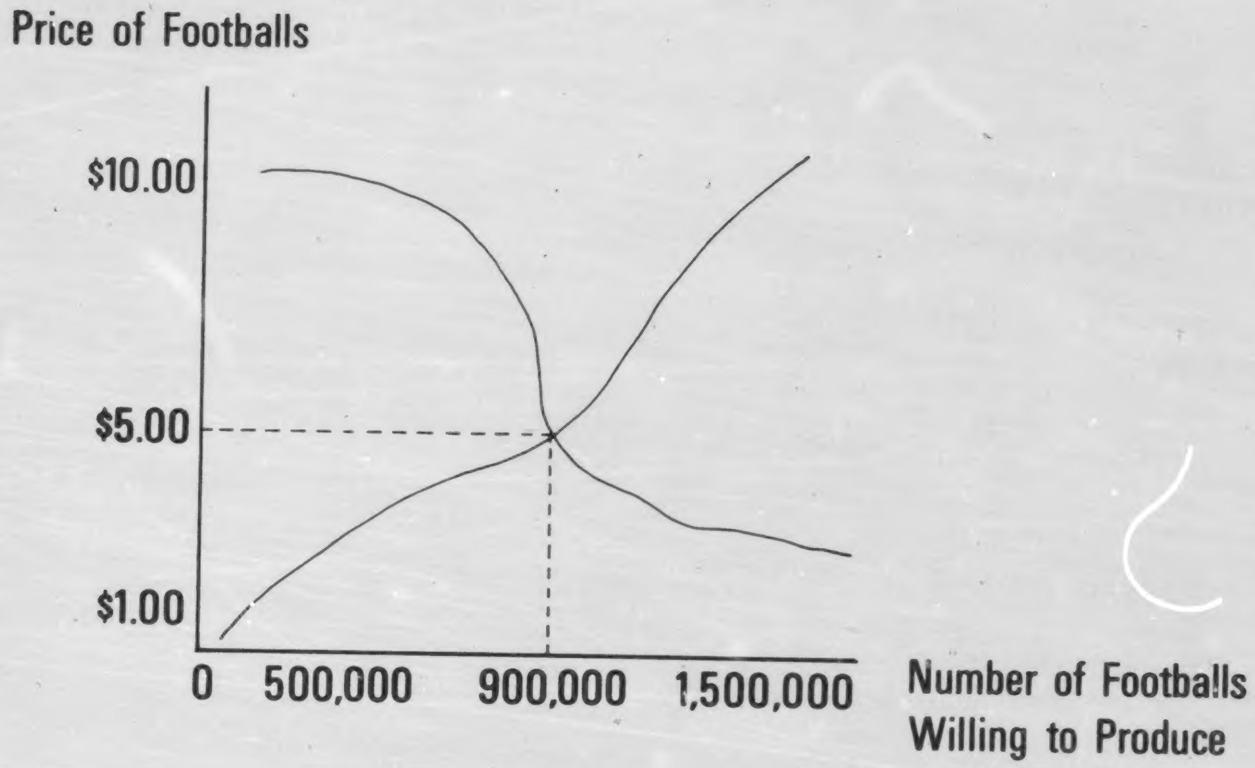

PRODUCTIVE RESOURCES
Labor
Savings
Property
GOVERNMENT
Wages
Salaries
Interest
Rent
TAXES
THE PUBLIC
Postal Services
Schools
Highways
FINISHED GOODS AND SERVICES

Supply and Demand Schedule

Price of Phonograph Album	Number of Phonograph Albums Wanted at that Price	Number of Phonograph Albums Supplied at that Price
$5.00	500,000	1,000,000
$4.00	600,000	900,000
$3.50	700,000	700,000
$3.00	800,000	600,000
$2.00	1,000,000	400,000

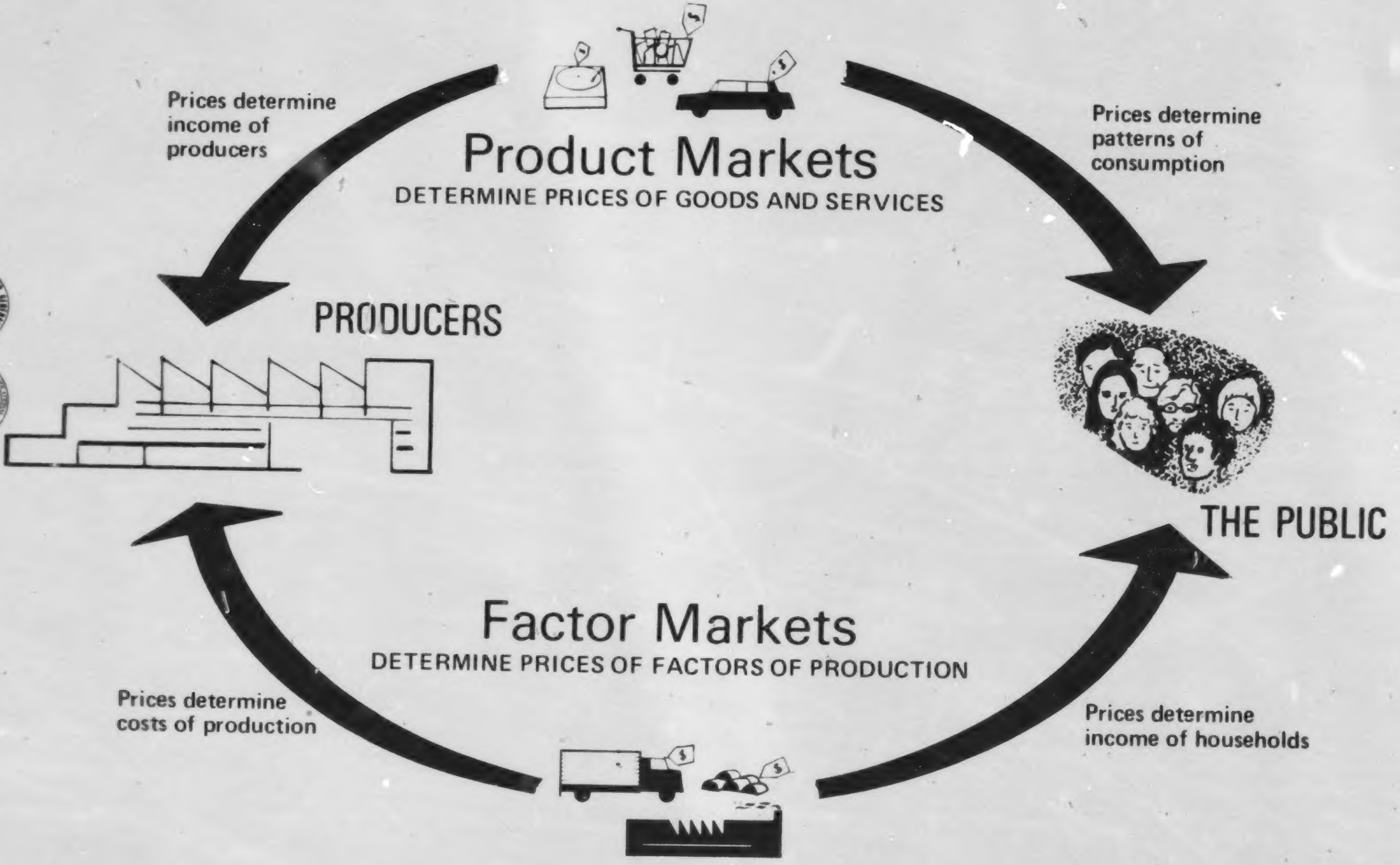
Supply and demand determines price and number produced

Supply and Demand Curves



At this point in time, 900,000 footballs would be produced at a price of $5.00 each

Ways Prices Influence the Economy



Product Markets

DETERMINE PRICES OF GOODS AND SERVICES

Prices determine income of producers

Prices determine patterns of consumption

PRODUCERS

THE PUBLIC

Factor Markets

DETERMINE PRICES OF FACTORS OF PRODUCTION

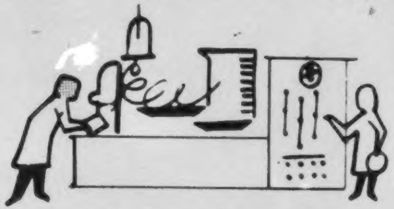
Prices determine costs of production

Prices determine income of households

Helping Growth

Stable Government

Encourages business, incentives for citizens



Research and Development

Quantities of new improved products at less cost

Modern Tools

Rising productivity, less drain on human energy

Mass Production

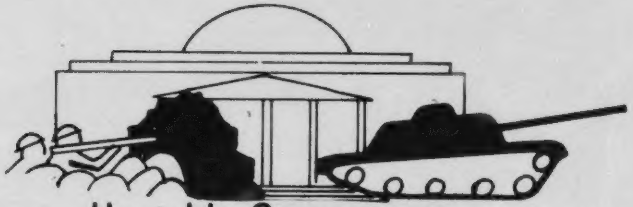
Abundant supply of low-priced goods

Hoover School

Mass Education

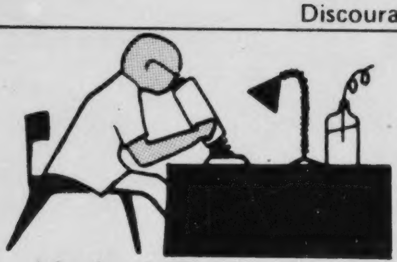
Increased supply of skilled labor

Limiting Growth



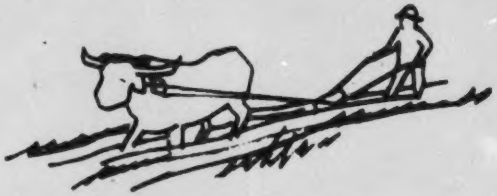
Unstable Government

Discourages business, uncertainties for citizens



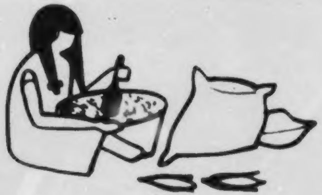
Limited Technology

Limited products and higher prices



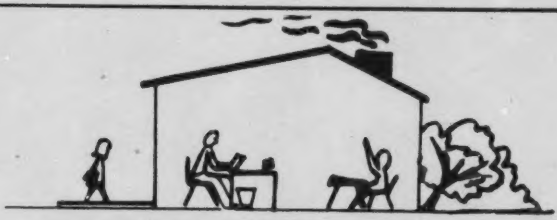
Primitive Tools

Low productivity, heavy drain on human energy



Production By Hand

Small supply of high-priced goods



Lack of Education

Shortage of labor skills

FREE ENTERPRISE SYSTEM
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Amount of a good or service that will be offered for sale at a given price and time

______b. Amount of a good or service wanted at a given price and time

______c. System where the factors of production (labor, management, property, and savings) flow from the public to the producers and where money payments (wages, salaries, interest, rent, and dividends) flow from the producers back to the public

___ d. System where goods and services are sold by producers to consumers who in turn pay money to the producers for these goods and services

______e Property owned by or due a business

______f. Economic and political system where the government controls *most* means of production

______g. Accumulated goods designed to bring in income

______h. Services performed by people with skills for wages

______i. Person who organizes and manages a business, assuming the risk for the sake of profit

______j. Ability to produce more goods and services with fewer resources

______k. System where most production is done by privately- owned corporations, partnerships, and private citizens in a free market

1. Demand
2. Supply
3. Product market
4. Factor market
5. Socialism
6. Assets
7. Labor
8. Capital
9. Technology
10. Entrepreneur
11. Free enterprise

_____l. Study of how persons can best consume, produce, and distribute goods and services to try to satisfy their never-ending and ever-increasing wants

_____m. Condition where demand is not affected much by a change in price

_____n. How much the demand for a good or service will increase if the price is lowered or how much the demand will decrease if the price is raised

_____o. Economic and political system characterized by elected representatives, *limited* government control, and freedoms such as freedom of speech, the right to own property, the right to choose a job, and freedom of religion

_____p. Economic and political system where the government leaders try to achieve equality by controlling *all* property and production and by deciding how and to whom goods and services are distributed

_____q. Materials supplied by nature

_____r. All claims against a corporation or entity

_____s. Skill to direct and control other resources

12. Economics
13. Elasticity
14. Inelasticity
15. Communism
16. Capitalism
17. Liabilities
18. Natural resources
19. Management

2. List the resources necessary for production of goods and services.

a. ____

b. ____

c. ____

d. ____

3. Match the economic goals of the American people on the right to the correct descriptions.

_____a. Protecting against risks people run into in their daily lives

_____b. Getting the most of time, energy, money, and abilities

_____c. Applying economic policies to the ideas about what is right and wrong

1. Economic efficiency
2. Economic justice
3. Economic security

______d. Obtaining better education, highways, hospitals, postal service, fire and police protection, and recreational facilities for all Americans

______e. Avoiding recessions, depressions, and inflation

______f. Going into business to produce whatever goods and services a person thinks he/she can sell at a profit

4. Economic freedom
5. Economic growth
6. Economic stability

4. List the roles of the government in the economy.

a. ____________________________________

b. ____________________________________

c. ____________________________________

5. Discuss in a short paragraph the roles of individuals and businesses in the economy.

____

____

____

____

____

____

____

____

____

____

6. Describe the functon of supply and demand schedules.

____

____

7. List the factors that determine the degree of elasticity of demand.

a. ____

____

b. ____

____

c. ____

____

8. Select from the list below ways prices influence the economy by placing an "X" in the correct blanks.

______a. Prices determine what will be produced by showing what is profitable and not profitable to sell

______b. Prices do not determine how scarce resources will be used

______c. Prices determine who can afford certain goods and services

______d. Individual decisions are not influenced by prices

______e. People collectively determine prices by what they are willing to buy

______f. Producers try to learn how consumers will "vote" or purchase goods and services by studying past sales records and by conducting marketing studies

9. List four benefits of competition and profit.

a. ____

____

b. ____

____

c. ____

____

d. ____

____

10. Discuss the characteristics of our modified free enterprise system.

11. Describe ways the government has become involved in the marketplace.

12. List three reasons that the government's role has increased.

a.

b.

c.

13. Discuss problems with government involvement in the economy.

14. Select from the list below reasons for striving to reach economic goals by placing an "X" in the correct blanks.

______a. Raise the standard of living for the upper class

______b. Have full employment

______c. Compete in the international market with countries such as Japan and Germany

______d. Meet the challenge of communism to replace the United States as the world's leading power

______e. Provide assistance and guidance to developing countries

______f. Raise standard of living for lower classes of employees

FREE ENTERPRISE SYSTEM
UNIT II

ANSWERS TO TEST

1. a. 2
   b. 1
   c. 4
   d. 3
   e. 6
   f. 5
   g. 8
   h. 7
   i. 10
   j. 9
   k. 11
   l. 12
   m. 14
   n. 13
   o. 16
   p. 15
   q. 18
   r. 17
   s. 19
2. a. Capital
   b. Management
   c. Labor
   d. Natural resources
3. a. 3
   b. 1
   c. 2
   d. 5
   e. 6
   f. 4
4. a. Producer and consumer
   b. Regulator and protector
   c. Promoter of economic goals of American people
5. Discussion should include:
   a. Individuals and businesses save money
   b. Savings are then invested in machines, tools, factories, stores, and offices
   c. Labor works to produce goods and services for itself and others
   d. Businesses provide wages, salaries, and stock dividends with which individuals can save and/or purchase goods and services
6. To determine price and quantity of good or service

7. a. Whether a good or service is a necessity or luxury
   b. Availablity and price of substitute products
   c. Amount of money people are willing and able to spend
8. a, c, e, f
9. Any four of the following:
   a. Stimulates the development of new or improved goods and services
   b. Causes scarce resources to be used as efficiently as possible
   c. Reduces prices
   d. Motivates people to open new businesses
   e. Creates new jobs
   f. Encourages more effective selling and promotion techniques
10. Discussion should include:
    a. Permits local, state, and federal governments to play a role in how resources will be used
    b. Allows some monopolies to exist
    c. Has profit motive as main incentive
    d. Maintains efficiency through competition in the marketplace
    e. Determines kinds and levels of production mainly by consumer purchases
    f. Provides rights to own property, to enter or leave a job, and to make contracts
11. Description should include:
    a. Floor (minimum) and ceiling (maximum) boundaries set on wages and prices
    b. Regulations on public utilities
    c. Tariffs on imports to encourage the sale of American goods
12. Any three of the following:
    a. Larger populations and movement to large cities require more goods and services
    b. Need for national defense has increased
    c. Desire for justice
    d. Desire for economic security

13. Discussion should include:
    - a. Government is not as efficient as private business
        - 1) Government agencies do not have to use resources wisely in order to make a profit or to compete
        - 2) Civil service safeguards lessen the influence of politics on government employees but may make it difficult to fire the people who may not do a job well
    - b. People often lose certain freedoms of choice
14. b, c, d, e

SAFETY AND FIRST AID
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to list rules for personal and general safety. The student should be able to match the correct fire extinguishers to the classes of fire and the colors of the safety color code to their applications. The student should be able to list safety rules involving an engine and flammable liquids, the immediate needs of a first aid victim, and the sequence of action applicable in case of serious injury. The student should complete the safety pledge form. This knowledge will be evidenced by completion of assignment sheets and unit test with 100 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with safety and first aid to the correct definitions.
2. Match the colors of the safety color code to their applications.
3. List rules for personal safety.
4. List rules for general job safety.
5. Select from a list methods used to maintain a clean and orderly work area.
6. Match the classes of fire to statements defining each class.
7. Select from a list the components of the fire triangle.
8. Match the types of fire extinguishers to the classes of fire for which each is best suited.
9. Identify the correct way to lift heavy objects.
10. List safety rules involving an engine.
11. List safety rules involving flammable liquids.
12. List the immediate needs of a first aid victim.
13. List the sequence of action applicable in case of serious injury.
14. Complete a safety pledge form.

SAFETY AND FIRST AID
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide student with objective sheet.

  B. Provide student with information and assignment sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information and assignment sheets.

  F. Contact a safety engineer as a resource person for class concerning safety on the job.

  G. Have students complete a first aid course and be certified according to OSHA regulations.

  H. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--The Fire Triangle

    2. TM 2--Types of Fire Extinguishers

    3. TM 3--Correct Way to Lift Heavy Objects

  D. Assignment sheets

    1. Assignment Sheet #1--Complete a Safety Pledge Form

    2. Assignment Sheet #2--Tips for Proper Job Safety

  E. Test

  F. Answers to test

III. Unit references:

A. Kidde Portable Extinguishers. *The ABC's of Fire Protection.* Belleville, New Jersey: Walter Kidde and Company, Inc.

B. U. S. Department of Health, Education, and Welfare, Office of Vocational Education, 1967.

C. Department of Labor. *Federal Register 36.* no. 105 (1971), part II.

D. Department of Education, Division of Vocational Education, State of New Jersey. *Safety Practices and Procedures in School Shops.* Trenton: New Jersey State Department of Vocational Education.

E. *Manual of Accident Prevention in Construction.* The Associated General Contractors of America, 1971.

F. *A Look at Service Safety.* Tecumseh, Michigan: Tecumseh Products Company.

G. Turcotte, Raymond H., and Patton, Bob. *Bricklaying Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1977.

H. Hendrix, Laborn J. "Bud," and Patton, Bob. *Cement Mason's Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1975.

I. Hendrix, Laborn J. "Bud," and Patton, Bob. *Construction Craftsman's Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1978.

IV. Films:

A. "Housekeeping Means Safekeeping." 146-009. Journal Films Inc., 930 Pitner Avenue, Evanston, Illinois 60602.

B. "Stop a Fire Before It Starts." 145-024. Journal Films Inc., 930 Pitner Avenue, Evanston, Illinois 60602.

SAFETY AND FIRST AID
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Safety--State or condition of being safe; freedom from danger, risk, or injury

   B. Accident--Any suddenly occurring, unintentional event which causes injury or property damage

   C. First aid--Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

   D. Occupational Safety and Health Act (OSHA)--Federal legislation designed to insure safe and sanitary working conditions for employees

   E. Flammable--Capable of being easily ignited and burning with extreme rapidity

   F. Explosive--Something tending to explode

   G. Combustible--Capable of exploding into flame

   H. Radiation--Combined processes of emission, transmission, and absorption of radiant energy

   I. Extinguish--To cause to cease burning

   J. Pressurized--Tank or container in which a liquid is stored under pressure greater than the pressure of the atmosphere

   K. Solvent--Liquid substance capable of dissolving or dispersing one or more other substances

   L. Pneumatic--Air-powered

   M. Hazard--Source of danger

II. Colors and applications of the safety color code

   A. Federal safety red

      1. Identifies fire protection equipment and its location

      2. Identifies portable containers of flammable liquids

INFORMATION SHEET

3. Identifies emergency stop bars, stop buttons, and emergency electrical stop switches on machinery

B. Federal safety yellow

1. Designates caution and marks physical hazards
2. Designates waste containers for explosive or combustible materials
3. Designates caution against starting, using, or moving equipment while under repair or against the use of defective equipment
4. Identifies the starting point or power source of machinery

C. Federal safety orange

1. Designates dangerous parts of equipment which may cut, crush, shock, or otherwise injure
2. Designates safety starter buttons and parts of equipment that may cause electrical shock
3. Designates exposed parts (edges only) of pulleys, gears, rollers, cutting devices, and power jaws

D. Federal safety purple--Designates radiation hazards

E. Federal safety green

1. Designates location of safety equipment
2. Designates location of first aid equipment

(NOTE: This applies to equipment other than fire-fighting equipment.)

F. Federal safety black and white (used individually or in combination)

1. Designates traffic flow
2. Designates housekeeping purposes
3. Designates storage areas

III. Personal safety rules

A. Wear clothing appropriate to the activity being performed

B. Confine long hair before operating rotating equipment

C. Wear safety glasses, suitable helmets, and goggles for cutting, chipping, grinding, and welding

INFORMATION SHEET

- D. Remove ties and loose sleeves when working around machine tools or rotating equipment
- E. Remove rings and other jewelry when working
- F. Be alert and conduct yourself in a manner conducive to safe practices
- G. Use soap and water frequently as a method of preventing skin disease
- H. Wear safety shoes and/or foot protectors
- I. Wear gloves when appropriate

IV. General job safety rules (Assignment Sheet #2)

- A. Keep all tools sharp, clean, and in safe working order
- B. Retain all guards and safety devices on power equipment
- C. Report defective tools, machines, or other equipment to the supervisor
- D. Report all accidents to the supervisor regardless of nature or severity
- E. Be sure machine operator turns off power and does not leave until machine has stopped
- F. Disconnect power from machine tools before performing maintenance tasks
- G. Use correct, properly fitting wrenches for nuts and bolts
- H. Use a solvent only after determining its properties, what kind of work it has to do, and how to use it
- I. Clean up any spilled liquids immediately
- J. Keep work area clear of scraps and litter
- K. Store oily rags and waste in proper containers
- L. Do not use compressed air to clean your person or clothing
- M. Use only approved scaffolding
- N. Use a swinging scaffold only after proper instructions and in accordance with OSHA regulations
- O. Make periodic checks of all machinery, tools, and equipment
- P. Operate all pneumatic or electric hoists strictly by the manufacturer's instructions and by OSHA regulations

INFORMATION SHEET

Q. Use safety hooks and all safety devices provided with crane and other lifting equipment

R. Maintain all guard rails and barricades

V. Methods used to maintain a clean and orderly work area

A. Arrange machinery and equipment to permit safety-efficient work practices and ease in cleaning

B. Stack materials and supplies safely in their proper places

C. Store tools and accessories safely in cabinets, on racks, or other suitable devices

D. Clear working areas of debris and other hazards

E. Clean floors from obstructions and slippery substances

F. Free aisles, traffic areas, and exits of materials and debris

G. Dispose of combustible materials properly

H. Store oily rags in self-closing or spring-lid metal containers

I. Know proper procedures to follow in keeping work areas clean and orderly

J. Keep sufficient brooms, brushes, and other housekeeping equipment readily available

VI. Classes of fire

A. Class A--Fires that occur in ordinary combustible materials, such as wood, rags, and rubbish

B. Class B--Fires that occur with flammable liquids, such as gasoline, oil, grease, paint, and thinners

C. Class C--Fires that occur in or near electrical equipment, such as motors, switchboards, and electrical wiring

D. Class D--Fires that occur with combustible metals, such as iron or magnesium

INFORMATION SHEET

VII. Components of the fire triangle (Transparency 1)

(NOTE: To produce fire these three elements are necessary and must be present at the same time. If any of the three is missing, a fire cannot be started. With the removal of any one of them the fire will be extinguished.)

A. Fuel

(NOTE: This is any combustible material.)

B. Heat

(NOTE: There has to be enough heat to raise the fuel to its ignition temperature.)

C. Oxygen

(NOTE: This is necessary to sustain combustion.)

VIII. Types of fire extinguishers (Transparency 2)

A. Pressurized water--Used on class A fires

B. Soda acid--Used on class A fires

C. Carbon dioxide (CO_2)--Used on class B and C fires

D. Dry chemical--Used on class B, C, and D fires

(NOTE: On class D fires, dry sand is as effective as any dry chemical. There are other more highly refined chemical fire extinguishers, but their cost places them out of reach of most shops.)

E. Foam--Used on class A and B fires

IX. Correct way to lift heavy objects (Transparency 3)

A. Lift with legs and not with back

B. Keep back straight

C. Do not lift heavy objects without help

X. Safety rules involving an engine

A. Engine operation should always be done under supervision of the supervisor

B. Use caution to prevent contact with hot manifolds and hoses

INFORMATION SHEET

- C. Do not pour gasoline into carburetor or head when starting an engine
- D. Be sure engine is out of gear and everyone is clear before starting engine

XI. Safety rules involving flammable liquids

- A. Store all flammable liquids in approved safety containers
- B. Do not operate an engine if fuel is leaking from any part of it
- C. Do not use gasoline to clean parts
- D. Use only approved cleaning solvents to clean parts
- E. Change oil- or gasoline-soaked clothing immediately
- F. Know the location and use of fire extinguishers for flammable liquids

XII. Immediate needs of a first aid victim

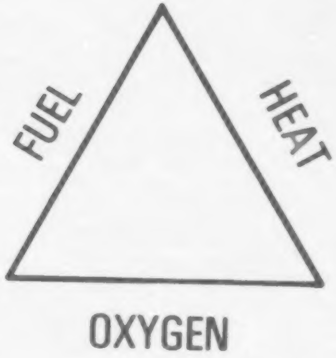
- A. Steadying effect of competent hands
- B. Well selected words of encouragement
- C. Expression of willingness to help
- D. Uplifting effect of the first aider's evident capability
- E. Thoughtful suggestions made to solve the immediate problems
- F. Telephone call to summon medical help
- G. Information given concerning nearby physicians and hospital
- H. Telephone call to notify relatives

XIII. Sequence of action applicable in case of serious injury

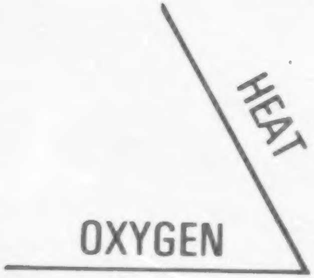
- A. Have victim lie down
- B. Check for injuries
- C. Plan what to do
- D. Carry out the indicated procedures

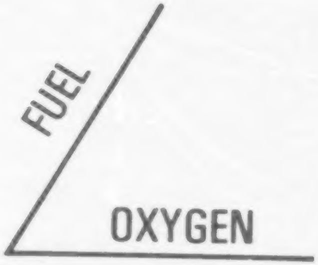
The Fire Triangle

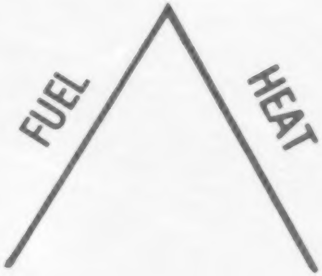
To produce fire, three things must be present at the same time.


FUEL
HEAT
OXYGEN

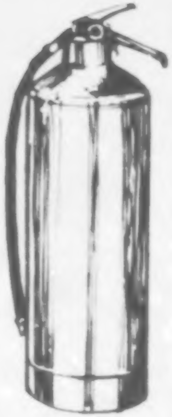
If any one of the three is missing, a fire cannot be started or, with the removal of any one, the fire will be extinguished.


HEAT
OXYGEN

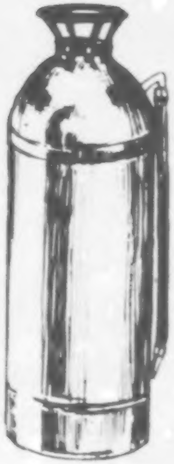

FUEL
OXYGEN



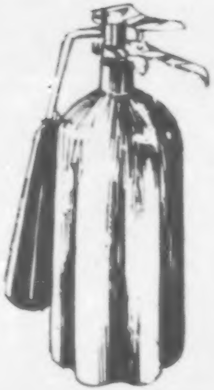
Types of Fire Extinguishers



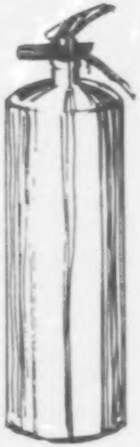
Pressurized Water



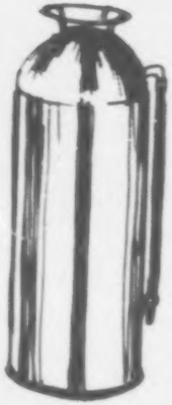
Soda Acid



Carbon Dioxide

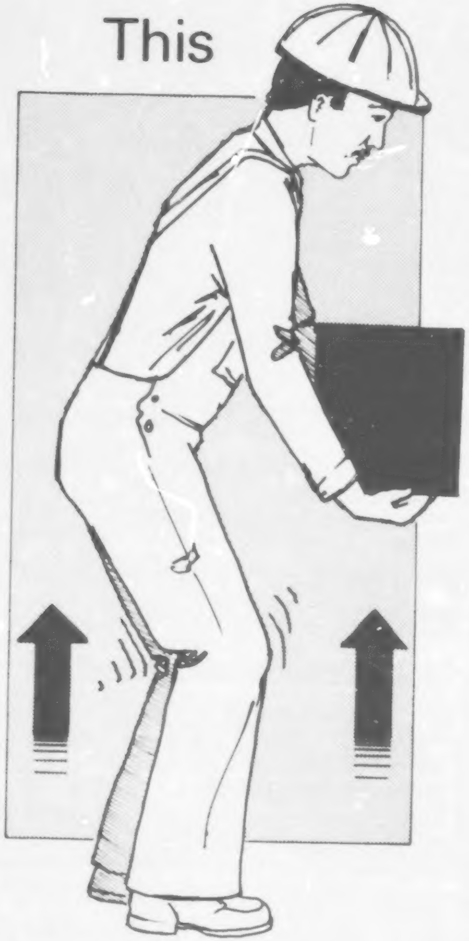


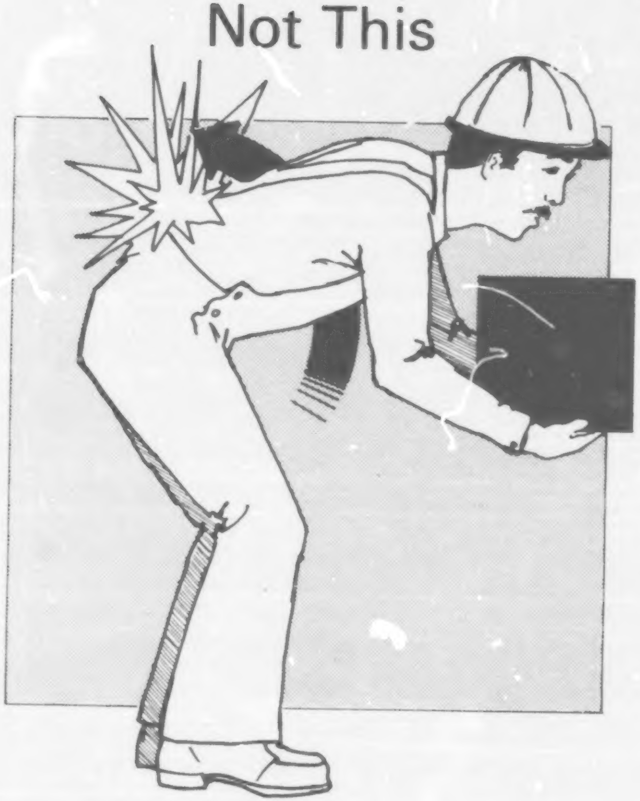
Dry Chemical



Foam

Correct Way To Lift Heavy Objects





SAFETY AND FIRST AID
UNIT III

ASSIGNMENT SHEET #1--COMPLETE A SAFETY PLEDGE FORM

It is understood that each student and/or employee will be given proper instruction, both in the use of the equipment and in correct safety procedures concerning it, before being allowed to operate it. The student must assume responsibility for following safe practices, and we, therefore, ask that the student subscribe to the following safety pledge.

1. I promise to follow all safety rules.
2. I promise never to use a machine without first having permission from the instructor.
3. I will not ask permission to use a particular machine unless I have been instructed in its use and have made 100% on the safety test for that machine.
4. I will report any accident or injury, no matter how minor, immediately to my instructor or supervisor.

Date ____________ Student's and/or employee's signature ______________________

Date ____________ Foreman's signature ______________________________

Date ____________ Supervisor's signature ______________________________

(NOTE: Parental consent is necessary if the student/employee is a minor.)

SAFETY AND FIRST AID
UNIT III

ASSIGNMENT SHEET #2--TIPS FOR PROPER JOB SAFETY

	Yes	No	Explanation or Comment
OSHA poster on the job.			
Copy of federal safety and health regulations for construction available on job.			
No employee "to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to health or safety."			
Regular and frequent inspection of job sites, materials, and equipment made by competent designated persons.			
Procedure established to identify unsafe tools, materials, or equipment by tagging or by locking controls or removing from use.			
Only qualified employees permitted to operate equipment or machinery.			
Housekeeping --			
--Work areas, passageways, stairs kept clear; projecting nails removed.			
--Scrap and debris removed at regular intervals.			
--Containers provided and used for waste, trash, other refuse, garbage.			
Person with valid certificate in first aid training available.			
Approved first aid supplies and kit available on job and checked at least weekly.			
Provisions made for prompt medical attention in case of serious injury.			
Equipment provided for transporting injured or communication system for contacting ambulance service.			

ASSIGNMENT SHEET #2

	Yes	No	Explanation or Comment
Emergency telephone numbers conspicuously posted.			
Adequate supply of potable (drinking) water provided, clearly marked; common cup prohibited.			
Toilets provided for employees on job site.			
Protection against effects of noise exposure provided through administrative or engineering controls or personal protective equipment.			
Construction areas lighted to minimum illumination requirements.			
Harmful dusts, fumes, mists, vapors, or gases controlled or ventilation provided.			
Hard hats worn by everyone in the construction area.			
Hearing protection (ear) provided where required.			
Eye and face protection provided where operation of machines presents potential eye or face injury.			
Appropriate respiratory equipment provided and used where required.			
Safety belts, lifelines, and lanyards provided and used where required.			
Safety nets provided where other protection is impractical.			
Fire protection program developed and followed.			
Water supply for firefighting.			
Fire extinguishers (water drums, fire hose) provided.			
Alarm or telephone system available for use in emergency.			

ASSIGNMENT SHEET #2

	Yes	No	Explanation or Comment
Proper storage practices observed for fire prevention.			
No Smoking or Open Flame signs posted and enforced where needed.			
Storage, use, and handling of flammable and combustible liquids in accordance with standards.			
Liquefied petroleum gas, storage, use, and handling in accordance with standards.			
Clearance, proper mounting, ventilation stability for temporary heating devices.			
Danger signs available and used only where an immediate hazard exists.			
Caution signs available and used only to warn against potential hazards or to caution against unsafe practices.			
Exit signs posted where required.			
Safety instruction and directional signs posted where required.			
Traffic signs posted where required.			
Accident prevention tags available and used where required.			
Flaggers used where required.			
Crane and hoist signals posted and used.			
Barricades provided where needed.			
All materials stored and stacked properly.			
Aisles and passageways kept clear.			
Rigging equipment for material handling inspected on each shift and load limits observed.			

ASSIGNMENT SHEET #2

	Yes	No	Explanation or Comment
Proper handling and disposal of waste materials.	____	____	____________
All solvent waste, oily rags, and flammable liquids shall be kept in fire resistant covered containers until removed from worksite.	____	____	____________
All hand and power tools maintained in safe condition.	____	____	____________
All power operated tools properly guarded.	____	____	____________
All hand-held power tools equipped with proper switch.	____	____	____________
Electric tools grounded or double insulated.	____	____	____________
Pneumatic power tools, fuel power tools, hydraulic power tools have required safeguards.	____	____	____________
Powder-actuated tools have required safeguards and operated only by trained personnel.	____	____	____________
Abrasive wheels and tools properly equipped and used.	____	____	____________
Woodworking tools properly equipped and used.	____	____	____________
Jacks rated and capacity not exceeded.	____	____	____________
Transporting, moving, and storing compressed gas cylinders according to standards. (Upright, secured, valves protected, kept from sparks or heat.)	____	____	____________
Placing of cylinders for welding and cutting according to standards.	____	____	____________
Employees instructed in safe welding and cutting practices.	____	____	____________
Fire prevention measures taken according to standards.	____	____	____________

ASSIGNMENT SHEET #2

	Yes	No	Explanation or Comment
Ventilation and protection in welding, cutting, and heating according to standards.			
Proper protective equipment provided.			
Employees protected from electric shock by grounding, guarding, or other means.			
Before work is begun, determine location of exposed or concealed electric lines to avoid personal contact.			
Portable equipment grounded or double insulated.			
Extension cords three-wire type.			
Temporary wiring properly installed.			
Temporary lighting properly protected and installed.			
Ladders with broken or missing rungs, broken side rails, or other defects removed from service			
Portable ladders have proper base, used at one to four pitch, top and bottom kept clear, properly secured.			
Ladder side rail extends 36" above landing area.			
Job-made ladders according to standards.			
Scaffolding, footing, and anchorage proper.			
All scaffolding operations under competent supervision.			
Guardrails (42" high) and toeboards on all scaffolds and platforms more than 10 feet high.			
Safety factor of "4" for scaffolds.			

ASSIGNMENT **SHEET #2**

	Yes	No	Explanation or Comment
Damaged or weakened scaffold parts removed.			
Scaffold timber and planks according to standards.			
Access ladder provided for scaffolds.			
Wire mesh or equivalent provided on scaffolds when persons must pass under.			
Floor and roof openings and holes effectively protected with standard guardrails or covers.			
Wall openings protected where opening is less than 3 feet above floor and where there is a drop of more than 4 feet.			
Open sided floors, platforms, runways more than 6 feet high equipped with standard guardrails.			
Stairways equipped with railings and handrails.			
Crane and derrick operations according to specifications and limitations of manufacturer.			
Operating speeds, warnings, instructions posted on equipment.			
Hand signal illustrations posted on job site and used.			
Competent person designated to inspect machinery and equipment prior to each use.			
Inspection records available.			
Wire rope used only according to standards.			
Moving parts on equipment guarded.			
Minimum clearance to electrical power line observed (never less than 10 feet) and person designated to observe and give warnings.			

ASSIGNMENT SHEET #2

	Yes	No	Explanation or Comment
No modifications to equipment that will affect capacity or safe operation without manufacturer's written approval.			
Crawler and truck cranes operated, maintained, inspected according to standards.			
Tower cranes and other cranes operated, maintained, inspected according to standards.			
Material hoists, personnel hoists, and elevators operated according to specifications and limitations of manufacturer and according to standards.			
Operating rules, including No Riders Allowed, posted at material hoists.			
Equipment marked with warning devices (reflectors, lights, etc.) after working hours when adjacent to public streets, highways.			
Off highway motor vehicles comply with standards and checked at beginning of each shift.			
Seat belts, brakes, operator protection on earth-moving equipment according to standard.			
Daily inspection of excavations by designated individual.			
Walkways, runways, sidewalks unobstructed and properly supported if necessary.			
Utility companies contacted and advised of proposed excavation operations.			
Trenching requirements, bracing, other safeguards according to standards.			
Concrete buggies, buckets, pumping systems, trowels, and equipment according to standards.			

ASSIGNMENT SHEET #2

	Yes	No	Explanation or Comment
Reinforcing steel placing and tying according to standards.	____	____	____________________
Forms and shoring equipment according to standards.	____	____	____________________
Drawing and plans for framework, shoring, etc. on job site.	____	____	____________________
Temporary or permanent floor according to standards. Safety nets where applicable.	____	____	____________________
Structural steel assembly according to standards.	____	____	____________________
Bolting, riveting, fitting up, and plumbing up according to standards.	____	____	____________________

(NOTE: Before blasting, consult the Internal Revenue Service, Alcohol, Tobacco and Firearms Division, Publication 740 [6-71].)

SAFETY AND FIRST AID
UNIT III

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. State or condition of being safe; freedom from danger, risk, or injury

______b. Any suddenly occurring, unintentional event which causes injury or property damage

______c. Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

______d. Federal legislation designed to insure safe and sanitary working conditions for employees

______e. Capable of being easily ignited and burning with extreme rapidity

______f. Something tending to explode

______g. Capable of exploding into flame

______h. Combined processes of emission, transmission, and absorption of radiant energy

______i. To cause to cease burning

______j. Tank or container in which a liquid is stored under pressure greater than the pressure of the atmosphere

______k. Liquid substance capable of dissolving or dispersing one or more other substances

______l. Source of danger

______m. Air-powered

1. Occupational Safety and Health Act (OSHA)
2. Radiation
3. Pressurized
4. Safety
5. Extinguish
6. Accident
7. Solvent
8. Flammable
9. Explosive
10. First aid
11. Combustible
12. Pneumatic
13. Hazard

2. Match the colors of the safety color code on the right to the correct applications by placing the appropriate numbers in the blanks provided. An answer may be used more than once.

_____a. Designates caution and marks physical hazards

_____b. Identifies fire protection equipment and its location

_____c. Designates location of safety and first aid equipment

_____d. Designates dangerous parts of equipment which may cut, crush, shock, or otherwise injure

_____e. Designates caution against starting, using, or moving equipment while under repair or against the use of defective equipment

_____f. Designates traffic flow

_____g. Designates radiation hazards

1. Federal safety green
2. Federal safety orange
3. Federal safety purple
4. Federal safety black and white
5. Federal safety red
6. Federal safety yellow

3. List five rules for personal safety.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

4. List ten rules for general job safety.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

5. Select from the list below methods used to maintain a clean and orderly work area. Place an "X" in the appropriate blanks.

______a. Stack materials and supplies safely in their proper places

______b. Clean floors from obstructions and slippery substances

______c. Use a dust rag on all machinery

______d. Dispose of combustible materials properly

______e. Place all oily rags in a cardboard box

______f. Clear working areas of debris and other hazards

______g. Have plenty of picks and shovels available for good housekeeping

______h. Know proper procedures to follow in keeping work areas clean and orderly

______i. Free aisles, traffic areas, and exits of materials and debris

______j. Be sure all brooms, brushes, and other housekeeping equipment are locked up in a safe place

6. Match the classes of fire on the right to statements defining each by placing the appropriate numbers in the blanks provided.

______a. Fires that occur with flammable liquids, such as gasoline, oil, grease, paint, and thinners

______b. Fires that occur in ordinary combustible materials, such as wood, rags, and rubbish

______c. Fires that occur in or near electrical equipment, such as motors, switchboards, and electrical wiring

______d. Fires that occur with combustible metals, such as iron or magnesium

1. Class A
2. Class B
3. Class C
4. Class D

7. Select from the list below the components of the fire triangle by placing an "X" in the appropriate blanks.

______a. Fire

______b. Oxygen

______c. Carbon dioxide (CO_2)

______d. Fuel

______e. Heat

______f. Water

8. Match the types of fire extinguishers on the right to the classes of fire for which each is best suited. Write the correct numbers in the blanks provided. A blank may have more than one correct answer.

______a. Used on class A fires

______b. Used on class B and C fires

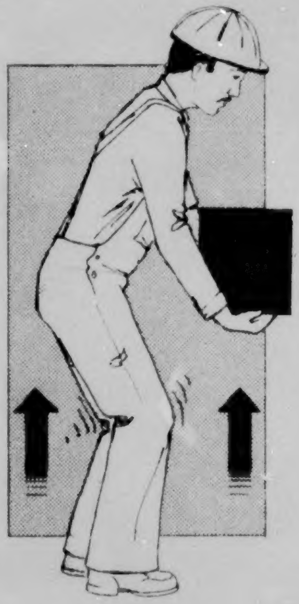
______c. Used on class B, C, and D fires

______d. Used on class A and B fires

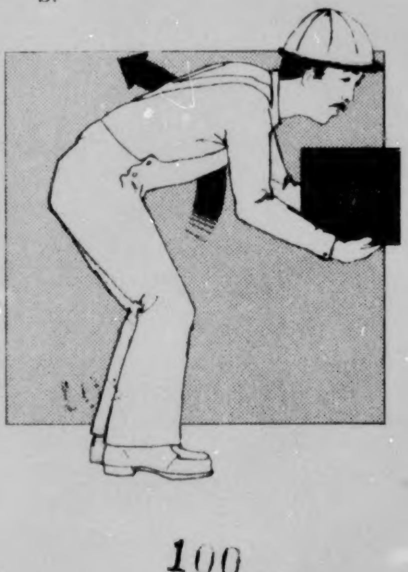
1. Pressurized water
2. Carbon dioxide (CO_2)
3. Dry chemical
4. Soda acid
5. Foam

9. Identify the correct way to lift heavy objects by circling the appropriate drawing.

a.



b.



10. List three safety rules involving an engine.

a. ______________________________

b. ______________________________

c. ______________________________

11. List four safety rules involving flammable liquids.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

12. List five immediate needs of a first aid victim.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

13. List the sequence of action applicable in case of serious injury.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

14. Complete a safety pledge form.

(NOTE: If activity fourteen has not been accomplished prior to the test, ask the instructor when it should be completed.)

SAFETY AND FIRST AID
UNIT III

ANSWERS TO TEST

1. a. 4
   b. 6
   c. 10
   d. 1
   e. 8
   f. 9
   g. 11
   h. 2
   i. 5
   j. 3
   k. 7
   l. 13
   m. 12

2. a. 6
   b. 5
   c. 1
   d. 2
   e. 6
   f. 4
   g. 3

3. Any five of the following:
   a. Wear clothing appropriate to the activity being performed
   b. Confine long hair before operating rotating equipment
   c. Wear safety glasses, suitable helmets, and goggles for cutting, chipping, grinding, and welding
   d. Remove ties and loose sleeves when working around machine tools or rotating equipment
   e. Remove rings and other jewelry when working
   f. Be alert and conduct yourself in a manner conducive to safe practices
   g. Use soap and water frequently as a method of preventing skin disease
   h. Wear safety shoes and/or foot protectors
   i. Wear gloves when appropriate

4. Any ten of the following:
    - a. Keep all tools sharp, clean, and in safe working order
    - b. Retain all guards and safety devices on power equipment
    - c. Report defective tools, machines, or other equipment to the supervisor
    - d. Report all accidents to the supervisor regardless of nature or severity
    - e. Be sure machine operator turns off power and does not leave until machine has stopped
    - f. Disconnect power from machine tools before performing maintenance tasks
    - g. Use correct, properly fitting wrenches for nuts and bolts
    - h. Use a solvent only after determining its properties, what kind of work it has to do, and how to use it
    - i. Clean up any spilled liquids immediately
    - j. Keep work area clear of scraps and litter
    - k. Store oily rags and waste in proper containers
    - l. Do not use compressed air to clean your person or clothing
    - m. Use only approved scaffolding
    - n. Use a swinging scaffold only after proper instructions and in accordance with OSHA regulations
    - o. Make periodic checks of all machinery, tools, and equipment
    - p. Operate all pneumatic or electric hoists strictly by the manufacturer's instructions and by OSHA regulations
    - q. Use safety hooks and all safety devices provided with crane and other lifting equipment
    - r. Maintain all guard rails and barricades
5. a, b, d, f, h, i
6. a. 2
    - b. 1
    - c. 3
    - d. 4

7. b, d, e

8. a. 1, 4, 5

    b. 2, 3

    c. 3

    d. 5

9. a

10. Any three of the following:

    a. Engine operation should always be done under the supervision of the supervisor

    b. Use caution to prevent contact with hot manifolds and hoses

    c. Do not pour gasoline into carburetor or head when starting an engine

    d. Be sure engine is out of gear and everyone is clear before starting engine

11. Any four of the following:

    a. Store all flammable liquids in approved safety containers

    b. Do not operate an engine if fuel is leaking from any part of it

    c. Do not use gasoline to clean parts

    d. Use only approved cleaning solvents to clean parts

    e. Change oil- or gasoline-soaked clothing immediately

    f. Know the location and use of fire extinguishers for flammable liquids

12. Any five of the following:

    a. Steadying effect by competent hands

    b. Well selected words of encouragement

    c. Expression of willingness to help

    d. Uplifting effect of the first aider's evident capability

    e. Thoughtful suggestions made to solve the immediate problems

    f. Telephone call to summon medical help

    g. Information given concerning nearby physicians and hospital

    h. Telephone call to notify relatives

13. a. Have victim lie down
    b. Check for injuries
    c. Plan what to do
    d. Carry out the indicated procedures
14. Evaluated to the satisfaction of the instructor

APPLYING FOR A JOB
UNIT IV

UNIT OBJECTIVE

After completion of this unit, the student should be able to locate a job opening, make a formal application, and effectively interview for a job. This knowledge will be evidenced by completion of assignment sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with applying for a job to the correct definitions.
2. List means of locating job openings.
3. List methods of applying for a job.
4. Select from a list personal attributes or attitudes an employer looks for during a personal interview.
5. Select from a list guidelines for dressing for an interview.
6. List items which an applicant may need to prepare when applying for a job.
7. Select from a list guidelines to follow when participating in a job interview.
8. Write a resume.
9. Write a letter of application for a carpentry job.
10. Complete employment application form for a job as a carpenter.
11. Practice interview questions.
12. Make an appointment by phone for a carpentry job interview.
13. Write a follow-up letter or make a follow-up phone call after interviewing for a carpentry job.
14. Evaluate a carpentry job offer.
15. Compare job opportunities.

APPLYING FOR A JOB
UNIT IV

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and assignment sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Invite resource person to discuss "What I look for on application letters, resumés, employment application forms, and follow-up devices" and "How do equal opportunity and affirmative action affect my hiring procedures?"

   G. Obtain actual letters of application and resumés to show to students.

   H. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Attitudes

      2. TM 2--Appropriate Dress

      3. TM 3--Take the Time to be on Time

   D. Assignment sheets

      1. Assignment Sheet #1--Write a Resumé

      2. Assignment Sheet #2--Write a Letter of Application for a Carpentry Job

      3. Assignment Sheet #3--Complete Employment Application Form for a Job as a Carpenter

4. Assignment Sheet #4--Practice Interview Questions

5. Assignment Sheet #5--Make an Appointment by Phone for a Carpentry Job Interview

6. Assignment Sheet #6--Write a Follow-up Letter or Make a Follow-up Phone Call after Interviewing for a Carpentry Job

7. Assignment Sheet #7--Evaluate a Carpentry Job Offer

8. Assignment Sheet #8--Compare Job Opportunities

F. Test

G. Answers to test

III. Unit references:

A. Blackledge, Ethel H.; Blackledge, Walter L.; and Keily, Helen J. *You and Your Job.* Dallas: South-Western Publishing Company, 1967.

B. Milburn, Paul M. *How to Get a Job.* Shawnee, Oklahoma: Gordon Cooper Area Vocational Technical School, 1967.

C. Moynihan, Moynihan, and Daeger. *You and Your Job--How to Get It.* Chicago: J. G. Ferguson Publishing Company, 1968.

D. Wood, Merle W., and McKeena, Margaret. *The Receptionist.* Dallas: McGraw-Hill Book Company/Gregg Division, 1966.

E. *Can I Get the Job?* Detroit: General Motors Public Relations Staff, 1972.

F. Keeton, Marsha. *Job Application and Interview.* University of Kentucky: Vocational Education Curriculum Development Center of Kentucky, 1973.

G. *Interviewing Women Candidates.* Washington, D. C.: U. S. Civil Service Commission, 1974.

H. *Your Attitude Is Showing.* Austin, Texas: Instructional Materials, Division of Extension, University of Texas, 1972.

I. Allen, Cliff. "About Getting a Job" and "After High School--What?" *Practical Family Life.* Greenfield, Mass.: Channing L. Bete, Inc., 1977.

J. Kimbrell, Grady, and Vineyard, Ben S. *Succeeding in the World of Work.* Bloomington, Illinois: McKnight Publishing Company, 1975.

K. Feingold, S. Norman, and Swerdloff, Sol. *Occupations and Careers.* St. Louis: McGraw-Hill Book Company/Webster Division, 1969.

APPLYING FOR A JOB
UNIT IV

INFORMATION SHEET

I. Terms and definitions

A. Award--Recognition received for outstanding achievement

B. Extracurricular activities--Clubs, organizations, and social or church groups in which one participates

C. Fringe benefits--Extras provided by an employer, such as paid vacations, sick leave, and insurance protection

D. Qualifications--Experience, education, and physical characteristics which suit a person to a job

E. Resumé--Brief, typed summary on one's qualifications and experience that is used in applying for a job

F. Vocational preparation--Any vocational courses and skills one has learned in high school or through work experience

G. Interview--Meeting of employer and job applicant for purpose of evaluation and questioning

H. Application form--Printed form on which job applicants record information about their personal history, job history, job experience, education, and references

I. Blind ad--Classified advertising that does not identify the advertiser

(NOTE: Applicant is asked to send a letter of application and resumé to a post office box number or to call a certain number.)

J. Help-wanted ad--Classified advertisement telling what kind of job is available and what the qualifications are

K. Employment-/situation-wanted ad--Classified advertisement placed by individuals seeking employment and telling what their qualifications are

L. Employment agency--Business that is designed to help individuals find employment

M. Garnishee--To attach wages or other property to satisfy a debt

N. Legible--Capable of being read; clear

O. Equal opportunity employer--Employer who is making a special effort to assure that no form of discrimination is practiced

Examples: Age, sex, race, creed

INFORMATION SHEET

II. Means of locating job openings

  A. Classified ads

    1. Newspapers

    2. Magazines

  B. Employment offices

    1. Department of Labor

    2. Private

  C. Local labor union business office

  D. School officials

    1. Teacher

    2. Counselor

    3. Principal

III. Methods of applying for a job (Assignment Sheet #5)

  A. Letter

  B. Telephone

  C. In person

IV. Personal attributes or attitudes an employer looks for during a personal interview (Transparency 1, Assignment Sheet #4)

  A. Enthusiasm and interest

  B. Dedication and dependability

  C. Alertness, quickness of mind

  D. Honesty and integrity

  E. Desire to work

  F. Desire to help others

  G. Desire to improve one's self

INFORMATION SHEET

V. Guidelines for dressing for an interview (Transparency 2)

- A. Job-related guidelines
    - 1. Kind of job

        (NOTE: A "rule of thumb" for any job interview is to dress better for the interview than you would for a day on the job.)
    - 2. Salary range
- B. Personal guidelines
    - 1. Coordinate clothing
    - 2. Be conservative
    - 3. Be modest and well-groomed

VI. Items which applicant may need to prepare when applying for a job (Assignment Sheets #1, #2, #3, and #6)

- A. Resume′
- B. Letter of application
- C. Application form
- D. Follow-up letter

VII. Guidelines to follow when participating in a job interview (Transparency 3)

- A. Preparing for the interview (Assignment Sheet #4)
    - 1. Be clean
    - 2. Be well-groomed and neat
    - 3. Wear appropriate clothes and shoes for the type of job
    - 4. Take an ink pen and resume′ with the information you may need about social security number, references, names and addresses, dates employed, and dates attended school
    - 5. Go alone; do not take parents or friends
    - 6. Do not be late; allow enough time

INFORMATION SHEET

7. Find out facts about the interviewer ahead of time
   a. Name

      (NOTE: Make sure you have the correct pronunciation.)
   b. Title
8. Know facts about the business
   a. Name
   b. Kind of business
   c. Products and services
   d. Reasons you want to work there
   e. How old the company is and where the plants, offices, or stores are located

B. Meeting the receptionist/secretary
   1. Smile
   2. Introduce yourself, stating that you have an appointment

      Example: "Good morning. I'm Terry McKracken and am applying for a job as rough framing carpenter. I have a 10:00 appointment with Mr. Smith."
   3. Follow receptionist's/secretary's instructions
   4. Wait patiently

C. Starting the interview
   1. Smile
   2. Listen
   3. Enter with poise
   4. Greet the interviewer by name
   5. Shake hands firmly
   6. Introduce yourself
   7. State purpose of call
   8. Be seated only at interviewer's invitation

9. Do not show signs of nervousness

   (NOTE: If you do not know where to put your hands, leave them on your lap and keep them still.)

10. Do not place personal things on interviewer's desk

11. Do not smoke or chew gum

12. Look alert; look interested and enthusiastic

    (NOTE: Sit slightly forward in chair to give an alert appearance.)

13. Be confident

14. Be courteous

    (NOTE: Words such as *Mr., Mrs., Miss, Ms., thank you, please,* and *sir* never go out of style.)

D. Answering questions clearly

1. Do not interrupt

2. Anticipate questions that might be asked and volunteer proper information

   a. Explain yes and no answers

   b. Avoid criticisms of former employers or competitors

   c. Do not talk about personal problems

   d. Show copies of your work if applicable

   e. State that you are willing to start at the beginning salary

   f. Answer all questions honestly

      Examples: "The thing I liked least about my last job was that I was on the night shift and couldn't get changed. I really wanted to be home with my family at night."

      "Truthfully, my relationship with my supervisor could have been better; we seemed to have a personality conflict and never became fond of each other. However, we did manage to work together. This was my first experience like that and I surely hope it doesn't happen again."

INFORMATION SHEET

g. Give positive answers to unfavorable questions

Examples: Interviewer: "Your work experience doesn't seem to relate specifically to this job. Why do you feel qualified to fill this position?"

Applicant: "I understand your concern. However, my job experience is broad enough to permit me to work into this particular situation. I have done work similar to this job and I think my general work record is good enough to convince you that I would be a good employee. I would be willing to receive additional training."

h. Find a true, positive statement about your reasons for leaving previous jobs, even if you were fired

Examples: "I was laid off, but I learned from my mistakes."

"I left because they did not need as many employees during the slow season."

i. Try to mention your best qualities in relation to something concrete

Example: "I earned 75 percent of my expenses while going to school" is better than "I am a hard worker and want to get ahead"

j. Be prepared for personal questions about your home life and parents' occupations

k. Avoid questions concerning politics, economics, religion, and other controversial subjects

l. Answer questions about career objectives using specific terms about what you would like to do in the near future in that particular field without limiting your opportunities

Example: A position as a carpenter that will lead to a supervisory position. No locational preference

3. Look directly at interviewer

4. Speak in clear, moderate tones

5. Use correct English

(NOTE: Avoid swearing, slang terms, or annoying phrases like "yea," "you know," or "uh-huh.")

INFORMATION SHEET

6. Show interest in the business; ask questions

   Example: Incorrect: "Listen, I need to know if you have any benefits."

   Incorrect: "Now that you've questioned me, there are a few things that I want to know before I decide if I want to work for you."

   Correct: "I wonder if you could give me some information about the benefits available to employees?"

7. Sell yourself

   (NOTE: Never refer to yourself as just average or fair. Always look for a positive response.)

8. Do not get flustered

9. Give the interviewer the opportunity to mention salary and fringe benefits

10. Act enthusiastically

E. Closing the interview

1. Watch for signs that the interview is over, such as the interviewer shuffling papers and moving around in chair

2. Ask "May I say one thing more?" or "Would you be interested in . . .?" if the interview seems to be ending before all important selling points have been made

3. Thank interviewer for his/her time

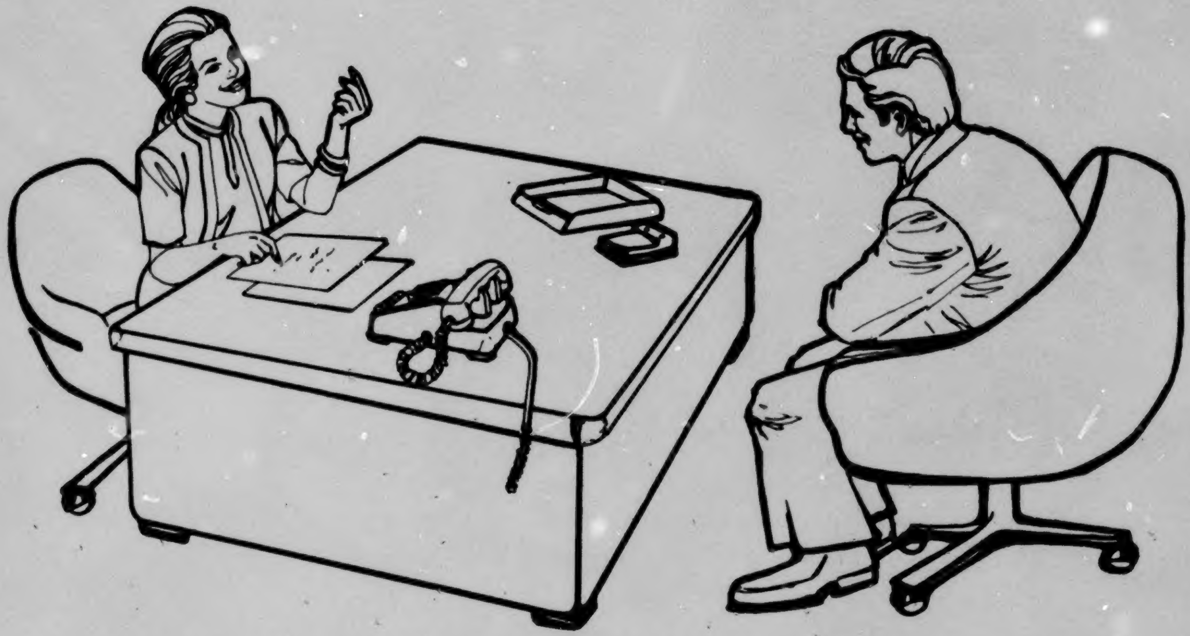
   Example: "I've enjoyed talking to you, Mr. Smith. Thank you for your time and consideration. I'm excited about this job and do hope I'm hired. Can you tell me when the position will be filled and how the applicants will be notified? (Answer) Please let me know if you need any additional information."

4. Learn from every situation even if the interviewer does not offer the position

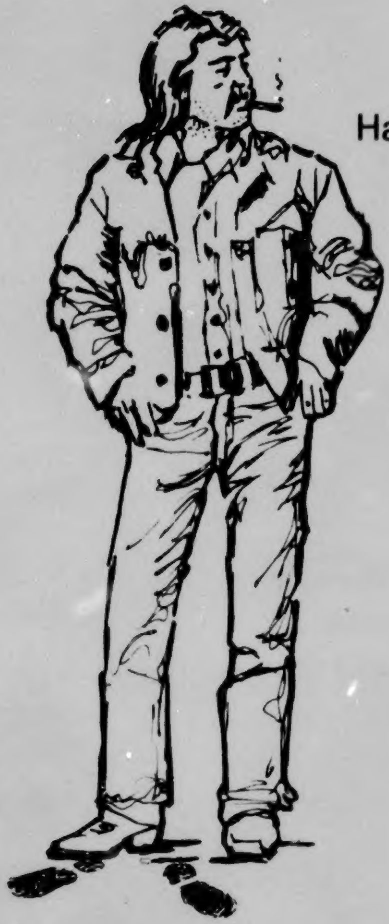
F. Following up the interview--Write thank you letter, call, or visit again to express interest in the job and appreciation for the opportunity to interview (Assignment Sheet #6)

Attitudes

Enthusiasm, Interest, Dedication, Dependability, Alertness, Quickness of Mind, Honesty, Integrity, Desire to Work, Desire to Help Others, Desire to Improve One's Self



Appropriate Dress

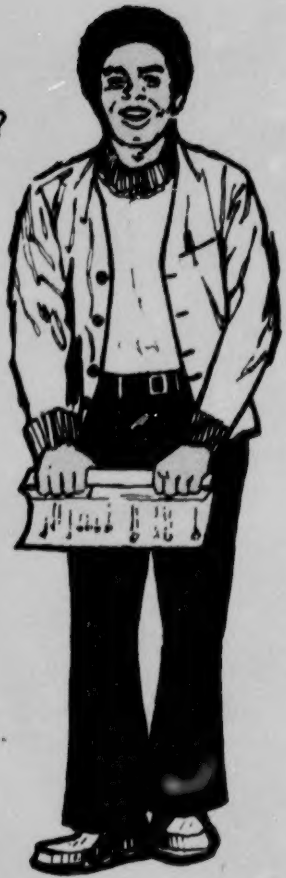


Hair neatly trimmed and Combed ?

Well-Groomed ?

Conservative and Coordinated Clothing ?

Shoes in Good Repair ?



Take the Time to be on Time

Resume
Want Ads
Memo
10:00 am
12
3
6
9

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #1--WRITE A RESUMÉ

Write a resumé using accurate facts about yourself. Include the resumé with a letter of application. Use the information below and the sample resumé included in this assignment sheet as guides. A good resumé should immediately give prospective employers a brief summary of your accomplishments, educational background, work experience, skills, and job objective. It is not necessary to use the exact wording and outline form used on the sample resumé, but it is necessary that your resumé be neat and balanced and contain all the information which might help you get a job. Keep a current copy of the resumé and use it to apply for jobs.

1. Inspect several resumé formats and choose one that best fits your needs or use the example included in this assignment sheet as a guide.
2. Type your resumé on 8 1/2 x 11 inch white paper. Try not to exceed one page but attempt to fill the page.
3. Spell correctly. Many employers will not consider persons who have resumés that include misspelled words.
4. Put your name prominently at the top in the center or upper left-hand corner. Beneath name, give full street address, city, state, zip code, telephone number with area code, and a number where messages can be accepted.
5. Do not include birthplace, age, health, height, weight, sex, marital status, photo, salary, or reasons for leaving previous job. Avoid religious and political affiliations.

   (NOTE: In general, the more information you are willing to share the better. However, the whole point of the resumé is to get employers interested to meet you in person. The above information may or may not come out in the interview. By not including this information there is little or no chance for discrimination because of race, color, religion, sex, or national origin.)
6. Describe your job objective or career goal briefly. Don't restrict yourself to a specific job unless you are experienced.
7. Describe your educational background, giving dates of enrollment, diploma or degrees received, and names of schools attended. Include grade average (if favorable) and major course of study. If you include school grades, be sure they are related to the jobs you have in mind.

   (NOTE: Applicants with less than one year of work experience should list education before work experience; with more than one year, put experience first. IN RESUMÉ WRITING, ACCENTUATE THE POSITIVE, ELIMINATE THE NEGATIVE. If pertinent, mention additonal courses, scholarships, or summer school.)

ASSIGNMENT SHEET #1

8. List your past employment, starting with your most recent job. Carefully examine all your jobs--including extracurricular activities. CONCENTRATE ON THE SKILLS; DON'T CATEGORIZE "SUMMER JOBS."

   (NOTE: The list should include the name of the company, your job title, and your major duties. The starting and termination dates for each job should be listed. Most employers ask during interviews why you left previous jobs. Try to be positive in stating your reasons for leaving a former job. Do not downgrade your previous employers.)

9. List skills useful to the job. Remember, you have to prove your value to the business, especially if you have little experience.

   (NOTE: Use active verbs to indicate the specific tasks you performed, e.g., built, assisted, operated.)

10. Include the following information if it is relevant and if there is enough space: hobbies and interests, extracurricular activities, clubs, awards you have received.

11. Ask at least three persons for recommendations; ask yourself the kinds of recommendations they will give you

    Examples: Business references, teachers, character references

    (NOTE: Avoid listing relatives unless you have actually worked for them on a salary basis. Include some method for prospective employer to acquire references.)

12. Write "Confidential" at the top of the resumé if you don't want your current employer to know you're looking for employment.

13. Have local printer retype your resumé and reproduce several copies. Request white bond paper.

    (NOTE: The physical appearance of your resumé is VERY important. Avoid using ditto or carbon copies. Be sure to proofread the printer's work. Always bring extra copies to interview. Leave one copy of resumé with interviewer and use one as a reference when filling out application form. You should also mail one resumé with your letter of application.)

ASSIGNMENT SHEET #1

SAMPLE RESUME

Terry McKracken

Address:	Present	Permanent
	774 E. Adams Street Yourtown, Yourstate 77704 405-311-7779	Route #3 Anytown, Yourstate 77702 405-235-4433
	(NOTE: You may ask printer to leave space for you to fill in address if you are moving.)	

Job Objective:	Career in the field of carpentry leading to supervisory position in the carpentry field
Education:	Anytown High School, Anytown, Yourstate 1975-1979
	Progress Vo-Tech, Progressville, Yourstate 1979 Certificate: Carpentry, four semesters Grade average: 3.5 on a 4.0 scale
Subjects Studied:	Vocational carpentry--Two years (1080 hours) Algebra--Two semesters Geometry--Two semesters Basic drafting--Two semesters Industrial arts woodworking--Two semesters
Student Activities:	President, Senior Class President, VICA Treasurer, Baptist Youth Fellowship Organization Carpentry contest, First Place State, Third Place National
Work Experience:	Carpenter's helper, Jones Construction Company, Summer 1979 Vocational Carpentry Class 1977-78, all phases of construction, Mr. Sammy Slavedriver, Instructor

References: (with permission)	Mr. Sammy Slavedriver Vocational Carpentry Instructor Progress Vo-Tech Progressville, Yourstate 77702	Mrs. Jerri Smith Youth Director Parkview Baptist Church 711 Fellowship Circle Anytown, Yourstate 77702
	Mr. John Naildriver Construction Supervisor Jones Construction Company Anytown, Yourstate 77702	

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #2--WRITE A LETTER OF APPLICATION FOR A CARPENTRY JOB

The application letter is a sales technique to tell the employer how your abilities will be useful to the business. The letter should specify your qualifications while the resumé gives general background information.

Cut a help-wanted ad for a carpentry job from the classified ad section of the local paper. Write an application letter to accompany the resumé you prepared in Assignment Sheet #1. Use the following information and the sample letter as a guide.

(NOTE: If you cannot type, it is recommended that you write or print NEATLY using blue or black ink.)

1. Use acceptable form and appearance
   a. Type or write neatly
   b. Write on only one side of the paper
   c. Avoid smudges and typographical errors
   d. Use 8 1/2" x 11" white bond paper, not personal or fancy paper
   e. Spell, capitalize, and punctuate correctly
   f. Put employer's full name, title, and address
   g. Include your full name and address with zip code on the letter
   h. Retain a copy for further reference
2. Include proper information
   a. Write to a specific person

      (NOTE: Find out the name of the personnel manager/employer you want to reach and the correct title. When in doubt, write to the top person who will refer your resumé to the right party. Use *To Whom It May Concern* if answering a blind ad.)
   b. Avoid excessive use of the pronoun "I"
   c. Be brief; do not repeat information in the resumé
      1) State the position for which you are applying
      2) Avoid needless details

ASSIGNMENT SHEET #2

3) Cover all points requested in the advertisement in exactly the order in which they were asked

(NOTE: Some prospective employers make it a point of testing the applicant's ability to follow directions.)

d. State reason for interest in job

(NOTE: Employers look for people who look for future advancement opportunities rather than just a paycheck.)

e. Refer briefly to the main points in the attached resume´

f. Mention that persons listed on the resume´ have given their permission to serve as references

g. Request interview at employer's convenience

1) Tell where you can be reached

2) Enclose self-addressed envelope and resume´

3) Say you will phone next week

3. Be original in your approach--Attract attention in opening paragraph

Examples:

Dear Mr. Money:

My expereince in carpentry would be of interest to you.

Dear Ms. Owner:

Mr. Co-worker informed me that you are in need of a person who can be a carpenter's helper. I believe that my experience and training have taught me how to handle these duties efficiently and accurately.

4. End the letter properly

(NOTE: *Sincerely yours* or *Very truly yours* is appropriate.)

5. Use permanent address for the return address and make sure to include the current date

6. Staple letter to resume´ as it may be circulated to several departments and otherwise become detached

ASSIGNMENT SHEET #2

7. Follow up and phone for an appointment a week later

   (NOTE: Don't be surprised if the resumé has been referred to another department. Remember, they are in business and you may not get immediate attention, especially if you sent a blind letter. Be persistent until you reach the right person and ask for a convenient date to set up an interview.)

8. Keep in touch regarding possible openings now and in the future

   (NOTE: The "job hunt" may take several weeks or even months! It's important to keep your contacts alive without being a nuisance.)

ASSIGNMENT SHEET #2

SAMPLE LETTER OF APPLICATION

Route #3
Anytown, Yourstate 77702
April 15, 1979

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Yourtown, Yourstate 77704

Dear Mr. Jones:

Please consider me for the job of rough framing carpenter that you advertised in the *Daily Chronicle*.

The skills I have learned in my high school vocational carpentry courses should qualify me for this job. I have had experience in all of the basic skills required in residential construction, including the safe use of power tools.

I will be graduating from high school in May, and I would like to become a carpenter. A more complete description of my qualifications is given in the enclosed resumé.

I would appreciate the opportunity to come and talk over this job opportunity at your convenience. I can be reached by telephone at 405-235-4433 after 3:30 or at the above address.

Sincerely yours,

Terry McKracken

Terry McKracken
Encl.

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #3--COMPLETE EMPLOYMENT APPLICATION FORM FOR A JOB AS A CARPENTER

Complete the following application form using the guidelines below. Use information corresponding to the classified ad and to your letter of application. Use information about yourself from your resume′

(NOTE: Although each business uses its own form, general rules of preparation apply to any form.)

1. Be prepared
   a. Take a good ink pen with you
   b. Take copies of resume′
2. Look over entire form before starting to write; do not hurry
3. Follow directions
   a. Note whether information is to be printed or handwritten
   b. Carry out all directions
4. Write clearly, neatly, and legibly
5. Answer briefly
6. Be honest
7. Answer all questions

   (NOTE: If questions do not apply to you, write *Not Applicable* or *NA* in the space to show that you did not overlook the question.)
8. Include complete information; use resume′
9. Recheck application when finished
10. Avoid cross-outs and obvious erasure marks
11. Do not list any restrictions to the geographical area in which you would work unless you absolutely will not consider other geographical areas
12. Use the word open for questions about minimum salary since most employers pay standardized rates and will not negotiate on this

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #4--PRACTICE INTERVIEW QUESTIONS

The following are some additional questions which might be asked when applying for various jobs. Keep the assignment sheet to review before going on any actual interview.

(NOTE: Questions about your personal life may not legally be asked. In fact, it is illegal for an employer to ask your maiden name or your father's surname if you are a female applicant; your marital status; who lives with you; the church you attend or the name of your spiritual leader; how many children you have, their ages, or who will care for them while you are at work; whether you own or rent your residence; whether you have ever had your wages garnisheed; and whether you have ever been arrested. However, many interviewers, particularly in smaller businesses, may ask such questions. Whether or not you chose to answer the questions depends on how badly you want the job.)

How would you answer the following questions? Why do you think each question might be asked?

1. Where do you go to school? When will you graduate?
2. Do you (did you) earn any of your own expense money while in school?
3. Why did you leave your previous job(s)?
4. What did you like best and what did you like least about your classes?

   (NOTE: This could be asked about teachers, jobs, or employers.)
5. What books have you read lately? What are your favorite magazines?
6. Are you in good health?
7. What do you expect to be doing five or ten years from now? What is your chosen field of work?
8. At what salary do you expect to start?
9. What are some of your special abilities? What skills do you possess? What tools or equipment can you operate?
10. How would you rate your training for this job? Very good? Fair?
11. What personal characteristics do you think are needed to succeed in your vocation?

ASSIGNMENT SHEET #4

12. In what area do you need the most improvement?

13. Do you like to work with other people or do you work best alone?

14. Do you have any questions you want to ask us?

15. Do you think your extracurricular activities were worth the time you devoted to them?

16. How could you contribute to our organization? Why should we hire you?

17. Tell us about your family and any plans for marriage or further education.

    (NOTE: REMEMBER: Legally, you do not have to answer this question. However, it is a good idea to prepare an answer in case such a question is asked.)

18. For what other jobs have you applied?

19. Do you have any military obligations to fulfill?

20. Give us an example of a project you finished under pressure.

21. May we write or call your last employer?

22. How many people have you supervised at work or through organizations of which you are a member?

23. How do you feel about the progress you have made salary-wise?

24. Would you be able to work all day Saturday and Sunday?

25. If you could start school (or work) over again what would you do differently?

26. What is your school attendance record?

27. Have you done the best school work of which you are capable?

28. Do you require attention? Does criticism disturb you?

    (NOTE: These questions are usually asked in a more subtle and indirect way.)

29. What motivates you?

30. Would you be willing to relocate?

31. What size city do you prefer?

ASSIGNMENT SHEET #4

32. Have you saved any money?

33. Define *cooperation*.

34. What job with our company would you choose if you were entirely free to do so?

35. How do you feel about working overtime?

REMEMBER: YOU NEVER GET A SECOND CHANCE TO MAKE A GOOD FIRST IMPRESSION!!! GETTING A JOB IS A JOB!!!

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #5--MAKE AN APPOINTMENT BY PHONE FOR A CARPENTRY JOB INTERVIEW

Making an appointment by phone does two things. First, it shows that you are interested in saving the employer's time. Second, it shows that you are thoughtful for asking what would be the best time for you to see the employer.

1. Steps in making an appointment by phone
   a. Plan what you are going to say before you call
   b. State your name and reason for calling

      Example: "Hello, this is Terry McKracken. I'm calling about your ad in last night's paper for a rough framing carpenter. May I have an appointment for an interview?"

   c. Ask when would be the best time for you to come for the interview
   d. Record the day, time, and place of the interview
   e. Thank the receptionist for the help
2. Things to remember when calling for an appointment
   a. Keep the receptionist on your side; the receptionist is there to help you

      (NOTE: The receptionist is sometimes asked to evaluate the applicant.)

   b. Do not ask over the phone how much the job pays
   c. Be polite and courteous

      (NOTE: Remember that this call is the first contact you may have with the firm. Make that first impression a good one.)

   d. Ask if you should pick up an application blank or if they would like to send it to you before the interview

Now that you have read about the correct way to arrange for a job interview, role play a situation where you make an appointment by phone. Use the checklist on the next page to evaluate your performance.

ASSIGNMENT SHEET #5

	YES	NO
Was prepared before calling		
Did not have to stammer to find the right words		
Identified self immediately		
Stated reasons for calling immediately		
Asked the best time for an appointment with employer		
Was courteous and friendly		
Asked about picking up application blank or having application blank sent prior to interview		
Thanked the receptionist		
Made record of the interview date, hour, and place		

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #6--WRITE A FOLLOW-UP LETTER OR MAKE A FOLLOW-UP PHONE CALL AFTER INTERVIEWING FOR CARPENTRY JOB

It is sometimes helpful to return to a business and check again on possible job openings. This is often done about a week after the first interview. This short casual visit accomplishes two things. It helps the interviewer remember you, and it shows that you have a sincere interest in working for that company.

However, it is not always possible to have this type of informal atmosphere when aplying for a job. In which case, it is always proper to send a follow-up letter or make a follow-up telephone call.

PART A

Write a follow-up letter thanking the employer for the interview. Use any form you wish or follow the format of the sample follow-up letter included in the assignment sheet.

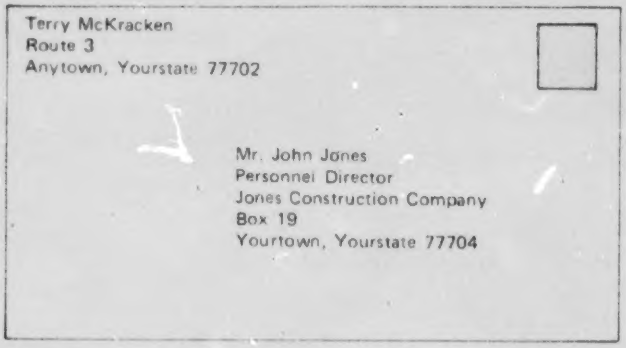
1. Make sure your letter meets the following standards
    a. Typed or written perfectly
    b. Clean, neat, and attractively arranged on the page
    c. Free from spelling, punctuation, and grammatical errors
    d. Sent within a day or two after the interview
2. Include the following points in your follow-up letter
    a. Expression of appreciation for interviewer's time and interest
    b. Summary of your qualifications and interest in position
    c. Your name, address, and phone number (to make it easier for your employer to contact you)
3. Make this last bid for the job a prime example of your excellent work habits; make the letter clean, neat, and well-worded

ASSIGNMENT SHEET #6

4. Address a legal-sized envelope (Figure 1)

(NOTE: Be sure and type the address EXACTLY the same as the inside address of the letter.)

FIGURE 1



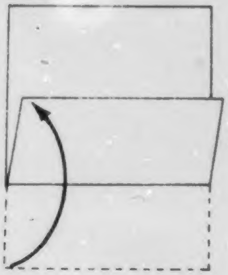
Terry McKracken
Route 3
Anytown, Yourstate 77702

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Yourtown, Yourstate 77704

5. Fold letter

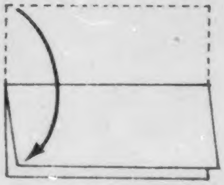
a. Fold slightly less than one-third of the letter toward the top (Figure 2)

FIGURE 2



b. Fold down the top of the letter to within 1 cm (1/2") of the bottom fold (Figure 3)

FIGURE 3



ASSIGNMENT SHEET #6

6. Insert the letter into the envelope with the last crease toward the bottom of the envelope (Figure 4)

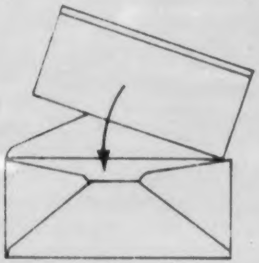


FIGURE 4

PART B

Role play a follow-up telephone call using the guidelines below.

1. Make sure you include the following information
    - a. Your name
    - b. Date of your interview
    - c. Position for which you were interviewed
2. Ask whether a decision has been made

Example: Incorrect: "Hello, Mr. Jones. This is Terry McKracken. You told me you would let me know about the job, but I haven't heard anything from you. Why haven't you called me?"

Incorrect: "This is Terry McKracken. Did I get the job?"

Correct: "Hello, Mr. Jones. This is Terry McKracken. I interviewed with you on June 30th for the position of rough framing carpenter. Have you made a decision on my application yet?"

ASSIGNMENT SHEET #6

3. If someone has already been hired, thank the interviewer for considering you but express continued interest in working for the company

Example:	Incorrect:	"Oh well, that's my luck. Thanks anyway."
	Incorrect:	"I didn't want to work for your company anyway."
	Correct:	I am sorry I was not hired. Thank you for at least considering my application. I am still interested in working for the company and would appreciate you keeping my application on file."

ASSIGNMENT SHEET #6

SAMPLE FOLLOW-UP LETTER

Route #3
Anytown, Yourstate 77702
April 30, 1979

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Yourtown, Yourstate 77704

Dear Mr. Jones:

Thank you for interviewing me for the job of rough framing carpenter with your company. I feel that working for Jones Construction Company would be enjoyable and that I could do the general rough framing work that the job requires. I hope that I will have the opportunity to prove my worth.

The application form you gave me is enclosed.

I will be available for work May 15. You may call me at my home after 3:30 p.m. The number 405-235-4433.

Sincerely yours,

Terry McKracken

Terry McKracken

Encl.

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #7--EVALUATE A CARPENTRY JOB OFFER

Instead of saying "yes" or "no" on the spot to a job offer, express your gratitude in a warm and friendly manner, and then ask if you may have time to consider the opportunity you have been offered. Few reputable employers will deny you a reasonable time to be certain before agreeing to take a job.

Avoid getting stuck with a job that's wrong for you by using the following checklist to evaluate the job offer.

THE JOB . . .

- ☐ Do I clearly understand the nature of the work and is it what I want to do? Are my responsibilities reflected in the job title?
- ☐ If this isn't my dream job, can it be a stepping stone as I acquire the skills and experience needed for advancement?
- ☐ Is the background I'm building so narrow that I will have difficulty transferring it to another employer?
- ☐ Will I be able to make any decisions affecting my work? Do I care?
- ☐ Will I need more training and will the company pay for it?
- ☐ Will overtime be necessary or available?
- ☐ Will I be able to leave all thought of the job behind at day's end? If not, do I care?
- ☐ Will I have to travel or relocate?
- ☐ Is the job permanent or temporary?
- ☐ If permanent, is there reasonable job security?
- ☐ Does this job require union membership?

THE COMPANY . . .

- ☐ Is the firm too large and heavy with rules for my personality?
- ☐ Is the firm too small to offer room for advancement or impressive credentials for a future resume?

ASSIGNMENT SHEET #7

☐ Does the firm have a healthy financial position and is it a growing organization?

☐ Is there a high turnover of personnel, and if so, why?

☐ Does the firm promote from within the ranks or turn to outsiders to fill supervisory jobs?

☐ Have I met the person who would be my immediate supervisor?

☐ Does the supervisor seem like the sort of person with whom I could get along?

☐ Do co-workers appear to be my kind of people?

☐ Is the company's location convenient?

☐ What is the firm's reputation for fair treatment of employees?

☐ Is a written personnel statement available that covers vacations, sick leave, cause for dismissal, and so forth?

FINANCIAL REWARDS . . .

☐ Do the earnings meet my minimum needs? Are there automatic cost-of-living increases?

☐ What is the method of payment--salary, hourly wage?

☐ Are raises based on merit, length of service, formal exams?

☐ What fringe benefits are given--health insurance, free parking, discount privileges, and others?

WHEN TO SAY NO . . . Should you always turn down an offer that doesn't measure up?

That depends on several questions. How desperately do you need to earn money? How competitive is the field you hope to enter, and would it be best to get your foot in the door any way you can? How valuable is the experience you'll gain? There are times when it is wise to accept a job which is not perfect in your eyes.

On the other hand, it could be best to refuse the offer.

Adapted from "If Things Don't Shape Up, I May Not Take the Job," Career World, February, 1977.

APPLYING FOR A JOB
UNIT IV

ASSIGNMENT SHEET #8--COMPARE JOB OPPORTUNITIES

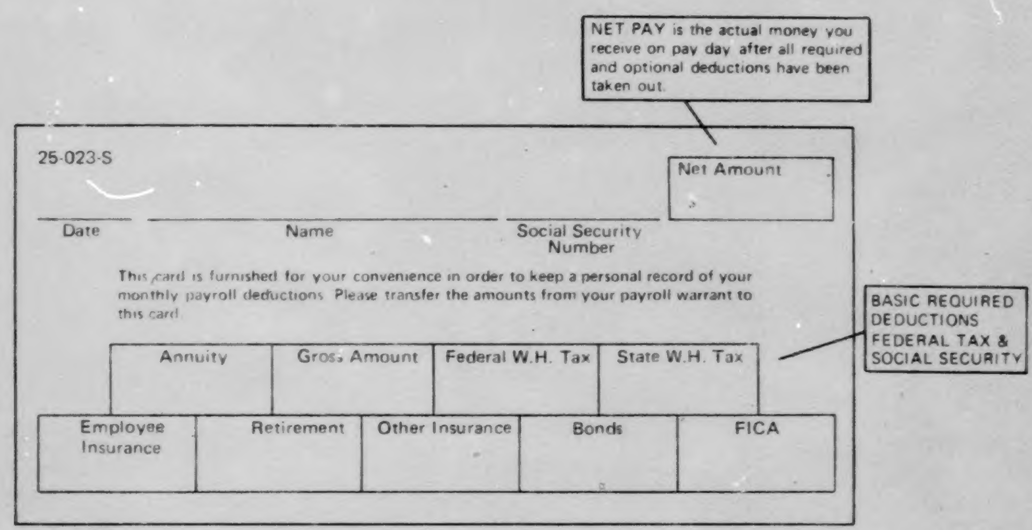
When you are offered a job or are changing jobs there are many factors to weigh before taking the position. Some of these include:

- What is your take-home pay?
- What are the benefits which accompany the job?
- How much will it cost to actually be at work each day?
- Would the job be satisfying to you?
- How would the job meet your needs and aspirations?

WHAT'S MY TAKE-HOME PAY?

Salaries and wages are often quoted by employers as gross earnings. Gross earnings are used because tax deductions vary due to the number of dependents, the amount of earnings, and other information.

Optional benefits and deductions offered by an employer also differ. It is generally advisable to ask what programs are available for enrollment as these can affect the actual money you receive on pay day.



NET PAY is the actual money you receive on pay day after all required and optional deductions have been taken out.

25-023-S

Net Amount

Date

Name

Social Security Number

This card is furnished for your convenience in order to keep a personal record of your monthly payroll deductions. Please transfer the amounts from your payroll warrant to this card.

	Annuity	Gross Amount	Federal W.H. Tax	State W.H. Tax
Employee Insurance	Retirement	Other Insurance	Bonds	FICA

BASIC REQUIRED DEDUCTIONS FEDERAL TAX & SOCIAL SECURITY

ASSIGNMENT SHEET #8

WHAT OTHER BENEFITS DO I GET FROM THIS JOB?

Some benefits associated with working are not always visible. Often some of these overlooked benefits are paid for in part by your employer. At the time of the interview or when considering a positon ask about:

- Employer's contributions for your protection which may include:
    - Health insurance
    - Unemployment compensation
    - Clothing and safety garments
    - Medical facilties and health tests
    - Pensions
    - Travel insurance (covering mishaps when traveling on business)
    - Educational programs or reimbursement for courses related to job
- Sick leave with pay
- Paid vacations and holidays

WHAT WILL IT COST TO WORK AT THIS JOB?

Frequently, we often overlook the costs which are associated with being employed. It may be of value to calculate estimated weekly expenses before you make a decision about a job.

Estimate weekly expenses for:

Transportation (parking, bus fares) $_____

Lunches (or cost of food eaten away from home, including soft drinks and coffee) $_____

Clothing (including cleaning) $_____

Child care for working parent $_____

Gifts for other employees $_____

Special uniforms, materials, or equipment for job $_____

Other $_____

TOTAL $_____

ASSIGNMENT SHEET #8

WHAT IS IMPORTANT TO ME IN A JOB?

Take-home pay and benefits may be only part of what you want from a job. Think through other things you consider important in a job.

What are some of the most rewarding things you've felt about any job you've ever had?

1. ____________________
2. ____________________
3. ____________________

How might you rate these in order of what's important to you?

______ Job security (little chance you'll be released from the job)

______ Opportunity for advancement

______ Recognition for your work

______ Good wages

______ Opportunity to learn and use your ideas

______ Flexible working hours

______ Long vacations

______ Pleasant working conditions

______ Interesting work

______ Friendly co-workers

______ Other, such as ____________________

ARE YOU READY TO DECIDE????

Take all the information you have gathered and summarize it below and on the next page to reach a decision about whether you want the job or not.

1. Would the job be satisfying to you? Why/why not?

____

____

____

ASSIGNMENT SHEET #8

2. What are the benefits which accompany the job?

____

____

____

____

3. How much will it cost to actually be at work each day?

____

____

____

4. How would the job meet your needs and aspirations?

____

____

____

5. I estimate my take-home pay to be $__________.

6. I estimate my expenses related to working to be $__________.

7. I would most enjoy the following about this job: __________________________

____

____

8. I estimate my job benefits to be worth $ __________.

APPLYING FOR A JOB
UNIT IV

TEST

NAME ____ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Brief, typed summary of one's qualifications and experience that is used in applying for a job

______b. Extras provided by an employer, such as paid vacations, sick leave, and insurance protection

______c. Recognition received for outstanding achievement

______d. Experience, education, and physical characteristics which suit a person to a job

______e. Any vocational courses and skills one has learned in high school or through work experience

______f. Clubs, organizations, and social or church groups in which one participates

______g. To attach wages or other property to satisfy a debt

______h. Meeting of employer and job applicant for purpose of evaluation and questioning

______i. Printed form on which job applicants record information about their personal history, job history, job experience, education, and references

______j. Business that is designed to help individuals find employment

______k. Classified advertising that does not identify the advertiser

______l. Classified advertisement placed by individuals seeking employment and telling what their qualifications are

______m. Classified advertisement telling what kind of job is available and what the qualifications are

1. Award
2. Interview
3. Extracurricular activities
4. Fringe benefits
5. Application form
6. Qualifications
7. Resumé
8. Garnishee
9. Vocational preparation
10. Employment agency
11. Equal opportunity employer
12. Blind ad
13. Help-wanted ad
14. Legible
15. Employment-/situation-wanted ad

______n. Capable of being read; clear

______o. Employer who is making a special effort to assure that no form of discrimination is practiced

2. List four means of locating job openings.

a. ____

b. ____

c. ____

d. ____

3. List the methods of applying for a job.

a. ____

b. ____

c. ____

4. Select from the list below personal attributes or attitudes an employer looks for during a personal interview. Place an "X" in the appropriate blanks.

______a. Alertness, quickness of mind

______b. Long wavy hair

______c. Dedication and dependability

______d. Enthusiasm and interest

______e. New car

______f. Honesty and integrity

______g. Desire to work

______h. Beard

______i. Flashy clothes

______j. Desire to help others

______k. Desire to improve one's self

5. Select from the list below guidelines for dressing for an interview. Place an "X" in the appropriate blanks.

______a. Kind of job

______b. Salary range

______c. What employer is wearing on the job ______d. Age of the interviewer

______e. Age of the interviewee

______f. Wear highly fashionable clothing

______g. Be modest and well-groomed

6. List items which an applicant may need to prepare when applying for a job.

a. ____

b. ____

c. ____

d. ____

7. Select from the list below guidelines to follow when participating in a job interview.

______a. Take parents or friends with you to job interview

______b. Know facts about the business

______c. Start the interview with a smile and greet the interviewer by name

______d. Place personal things, such as coat, hat, or purse, on interviewer's desk

______e. Criticize former employers or competitors when applicable

______f. State that you are willing to start at the beginning salary

______g. Answer all questions honestly

______h. Ask questions about politics, economics, religion, and other controversial subjects

______i. Look directly at interviewer

______j. Do not ask questions or show interest in the business

______k. Thank interviewer for his/her time

______l. Write thank you letter, call, or visit again to express interest in the job and appreciation for the opportunity to interview

8. Write a resumé.

9. Write a letter of application for a carpentry job.

10. Complete employment application form for a job as a carpenter.

11. Practice interview questions.

12. Make an appointment by phone for a carpentry job interview.

13. Write a follow-up letter or make a follow-up phone call after interviewing for a carpentry job.

14. Evaluate a carpentry job offer.

15. Compare job opportunities.

(NOTE: If activities 8-14 have not been accomplished prior to the test, ask your instructor when they should be completed.)

APPLYING FOR A JOB
UNIT IV

ANSWERS TO TEST

1. a. 7
   b. 4
   c. 1
   d. 6
   e. 9
   f. 3
   g. 8
   h. 2
   i. 5
   j. 10
   k. 12
   l. 15
   m. 13
   n. 14
   o. 11

2. Any four of the following:
   a. Classified ads
      1) Newspapers
      2) Magazines
   b. Employment offices
      1) Department of Labor
      2) Private
   c. Local labor union business office
   d. School officials
      1) Teacher
      2) Counselor
      3) Principal

3. a. Letter
   b. Telephone
   c. In person

4. a, c, d, f, g, j, k

5. a, b, g

6. a. Resumé

   b. Letter of application

   c. Application form

   d. Follow-up letter

7. b, c, f, g, i, k, l

8. Evaluated to the satisfaction of the instructor

9. Evaluated to the satisfaction of the instructor

10. Evaluated to the satisfaction of the instructor

11. Evaluated to the satisfaction of the instructor

12. Evaluated to the satisfaction of the instructor

13. Evaluated to the satisfaction of the instructor

14. Evaluated to the satisfaction of the instructor

15. Evaluated to the satisfaction of the instructor

COMMERCIAL CARPENTRY
PROGRESS CHART

Section A
Introduction

Student's Name	UNIT I ORIENTATION			UNIT II FREE ENTERPRISE SYSTEM		UNIT III SAFETY AND FIRST AID				UNIT IV APPLYING FOR A JOB									
	1	2	3		2	1	2	3	4	1	2	3	4	5	6	7	8	9	10
Job	UNIT TEST	Complete Personal Information Sheet		UNIT TEST		UNIT TEST	Complete Safety Pledge Form	Tips for Proper Job Safety		UNIT TEST	Write a Resume	Write Letter of Application for a Carpentry Job	Complete Employment Application Form for Job as a Carpenter	Practice Interview Questions	Make Appointment by Phone for Carpentry Job Interview	Write Follow-up Letter or Make Follow-up Phone Call After Interviewing for Carpentry Job	Evaluate Carpentry Job Offer	Compare Job Opportunities	
1																			
2																			
3																			
4																			
5																			

Accuracy	85% Correct	85% Correct		85% Correct		100% Correct	100% Correct	100% Correct		85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct		85% Correct	85% Correct	
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Section B

Leadership

PARLIAMENTARY PROCEDURE AND PUBLIC SPEAKING
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to conduct a meeting using the proper order of business and parliamentary procedure. The student should also be able to list the purposes for making a speech, the basic parts of the speech, and the three "ups" of speech delivery. This knowledge will be evidenced by completion of the assignment sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Name the principles upon which parliamentary procedure is based.
2. Select from a list the characteristics of a good chairman.
3. Arrange in order the suggested order of business.
4. Select from a list those things that make a good meeting.
5. Describe the proper way to introduce a motion.
6. Match categories of motions to the correct definitions.
7. Select from a list true statements about the characteristics of various kinds of motions.
8. Select from a list true statements about basic rules for parliamentary procedure.
9. List the purposes for making a speech.
10. List the basic parts of a speech.
11. List the three "ups" of speech delivery.
12. Conduct a meeting.

PARLIAMENTARY PROCEDURE AND PUBLIC SPEAKING
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and assignment sheets.

   C. Discuss unit and specific objectives.

   D. Have students conduct a business meeting using correct parliamentary procedure; duplicate the chart on objective seven to be used as a handout during the role play situations and actual meetings.

   E. Have students give speeches.

   F. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency master: TM 1--Precedence of Common Motions

   D. Assignment Sheet #1--Conduct a Meeting

   E. Test

   F. Answers to test

III. Unit references:

   A. Gray, Jarrell D. *Parliamentary Guide for Vocational Industrial Clubs of America.* Wolfe City, Texas: Texas Association, Inc., Henington Publishing Company.

   (NOTE: This guide can be ordered for $.35 from Dr. Jarrell D. Gray, Box 717, Commerce, Texas 75428.)

   B. Sturgis, Alice F. *Parliamentary Procedure.* New York, New York: McGraw-Hill Book Company, Inc.

IV. Additional materials:

A. "Workbook of Parliamentary Guide for Vocational Industrial Clubs of America." Vocational Industrial Clubs of America, Oklahoma Association, State Department of Vocational and Technical Education, 1515 West Sixth, Stillwater, OK 74074.

(NOTE: This is available only to Oklahoma teachers. It can be ordered from the above address for $.35. The teacher's key is free.)

B. Robert, Henry M. *Robert's Rules of Order.* New York: Pyramid Publications, 1967.

PARLIAMENTARY PROCEDURE AND PUBLIC SPEAKING
UNIT I

INFORMATION SHEET

I. Principles upon which parliamentary procedure is based

- A. Right of the majority to rule
- B. Right of the minority to be heard and protected

II. Characteristics of a good chairman

(NOTE: There is some use of the terms *chairperson* and *chairwoman* to recognize that many women hold positions of leadership. However, according to the National Association of Parliamentarians, the term *chairman* or *madame chairman* will continue to be used to mean the person who is in the chair. The term *madame chairman* is appropriate when a female is in the leadership position.)

- A. Is impartial
- B. Inspires confidence in the members
- C. Provides leadership
- D. Asks if there are any additions and/or corrections to the minutes
- E. Repeats motions and amendments exactly as they were stated before voting

III. Suggested order of business

(NOTE: An agenda or order of business is a list, outline, plan, or program of things to be done. A printed order of business with details about the new business, unfinished business, or reports makes a meeting run much smoother.)

- A. Meeting called to order
- B. Special program of a serious nature

  (NOTE: This could be a program such as the opening ceremony, flag salute, creed, or devotional.)

- C. Meal (if a meal function)
- D. Reading minutes of previous meeting and taking roll
- E. Treasurer's report

INFORMATION SHEET

F. Committee reports

Examples: Officers, standing committees, special committees

G. Unfinished business

H. New business

I. Program

J. Announcements, introductions, correspondence, awards, or closing ceremony

(NOTE: Some of these activities may come before committee reports if desired.)

K. Adjournment

L. Refreshments and recreation

IV. Things that make a good meeting

A. Advanced planning and practice by the executive committee

(NOTE: It is suggested that an agenda be prepared ahead of time.)

B. Arranging the seating plan so everyone can see the program

C. Proceeding according to the order of business

D. Conducting business according to parliamentary procedure

E. Preparing written and oral committee's, secretary's, and treasurer's reports

F. Beginning and ending on time

G. Moving along with "snap" to prevent boredom and wasted time

H. All members expressing appreciation to guests for their attendance

I. All members being involved in at least one committee

J. Proceeding with minimum participation by the advisor(s)

K. Helping with any clean-up duties

INFORMATION SHEET

L. Having an official greeter to make everyone feel welcome and to prevent interruptions of serious portions of the meeting

Example: Members entering late may wait until after the devotional and flag salute to be seated

M. Giving the guest speaker some indication of the topic desired and length of the speech

V. How to introduce a motion

A. Have only one main motion on the floor at a time

B. Receive recognition by the chair before speaking

Example: Raise hand, stand up

C. Stand and address the chair as "Mr. Chairman" or "Madame Chairman"

D. Say "I move . . ."; do not say "I make a motion . . ." or "I move that . . ."

E. Word all motions in a positive way so that a "yes" vote means the membership is in favor of the proposed motion

VI. Categories of motions

A. Main motion--To introduce business for the assembly's action

(NOTE: Only one main motion may be considered at a time, and it excludes all other main motions until it has been disposed of.)

B. Subsidiary motion--To change or amend the main motion under consideration

(NOTE: Subsidiary motions should be voted on before the main motion is voted upon.)

Examples: Motion to amend a main motion
Motion to lay on table

C. Privileged motion--To act upon questions of great importance which have no connection with the main motion

Example: Motion to adjourn

D. Incidental motion--To answer questions arising from the business procedures being conducted

Examples: Point of order, division of assembly, inquiry of information, suspend the rules

INFORMATION SHEET

VII. Characteristics of various kinds of motions (Transparency 1, Assignment Sheet #1)

A. Subsidiary motions

Kind of Motion	Purpose	Effect	Example
To amend (NOTE: This requires discussion or debate just like a main motion.)	To improve the motion or amendment through additions, deletions, or corrections	To change the original motion	"I move to amend motion by . . ."
To call for the previous question (NOTE: Requires a second and a 2/3 vote if continued debate is desired by some members.)	Secure immediate vote on pending question	Ends debate	"Call for the question." "Question."
To lay on the table (NOTE: It must be voted to remove the issue from the table before the issue can be discussed once this motion has been passed.)	Clear the floor for more urgent business	Delays action; wait awhile	"I move we table this motion."

INFORMATION SHEET

Kind of Motion	Purpose	Effect	Example
To commit or refer to committee	To enable more careful consideration and study to be given	Delays action	"I move to refer the motion to a committee to determine if . . ."
To limit or extend time for debate	Provides more or less time for discussion	Shortens or lengthens discussion period	"I move we limit debate to five minutes for each side."
To postpone indefinitely (NOTE: This requires discussion or debate.)	To prevent a vote on the question	To suppress the question	"I move we postpone this motion until the funds become available."
Friendly amendment (NOTE: This is not an "official" amendment, but one that is frequently used in an informal setting.)	To change a motion or amendment with the approval of the person making the motion or amendment (NOTE: Does not require a vote.)	To change an obvious oversight	"I'd like to make a friendly amendment with Judy's approval to have the motion include the curfew at 1:00 a.m."
B. Privileged motions			
To adjourn	End the meeting	Adjourns the meeting	"I move we adjourn."
To take a recess (NOTE: There may be limited discussion on this issue.)	To secure an intermission or break	Delays action	"I move we recess until 2:45."

INFORMATION SHEET

Kind of Motion	Purpose	Effect	Example
To raise a question of privilege (NOTE: May interrupt speaker to raise this question.)	To correct undesirable conditions, such as a light shining in someone's eyes through an open window	Corrects undesirable condition	"Question of personal privilege. Could we turn the heat up in this room?"
To call for the order of the day (NOTE: This motion requires a second and discussion.)	To secure adherence to order of business	Same as disagree	"Call for the order. I believe we are in old business, not new business, at this time."
Incidental motions			
To raise a point of order (NOTE: May interrupt speaker to raise this question.)	To call attention to violation of rules	Keeps group functioning according to parliamentary procedures	"Point of order" or "I rise to a point of order. We already have a motion on the floor."
To suspend the rules (NOTE: Requires a 2/3 vote.)	To permit action not possible under the rules	Secure action which would otherwise be prevented by the rules	"I move we suspend the rules about filing for an office at least two weeks in advance for this session only."

INFORMATION SHEET

Kind of Motion	Purpose	Effect	Example
To call for a division (NOTE: This does not require a second but does require a majority vote.)	To check the accuracy of a voice vote; to secure expression of individual member's vote	Secures an accurate check on a vote through some visible means, such as raising hands, standing, or taking a roll call vote	"Call for a division of the house" or "I call for a roll call vote."
Parliamentary inquiry or point of information	To obtain information about the issue or business procedure	Clarifies a point or questions the legality of the procedure	"Point of parliamentary inquiry. Doesn't it require a 2/3 vote to suspend the rules?" or "Point of information. Did you say the camera cost $135?"
To appeal the decision of the chair	To determine the attitude of the group on the ruling made by the chair	Secures ruling of the group rather than by the chair	"Appeal the decision of the chair."
To open or close nominations for an office (NOTE: This requires a 2/3 vote.)	To stop or add more candidates	Determines the number of candidates	"I move the nominations cease.
Take from the table	Bring back an issue that has been tabled for further discussion	Further consideration	"I move we take from the table the motion to buy a camera."

INFORMATION SHEET

VIII. Basic rules for parliamentary procedure

(NOTE: Check your organization's constitution for exceptions to these rules.)

A. Member may change vote up to the time the vote is announced unless the vote is by secret ballot

B. Member cannot be required to vote

C. All blank ballots or members not voting are ignored and are not considered in determining quorum, majority, two-thirds, or unanimous vote

D. Candidate for a position should never be elected by plurality vote (receiving the largest vote of any candidate), but candidates receiving low votes must be eliminated until one candidate receives a majority vote

E. Motion or amendment may be broken down into parts and each part voted upon separately

F. No member should be allowed to discuss an issue a second time unless all members have had an opportunity to speak

G. First speaker in a debate or discussion should be allowed to make the final statement before discussion is closed

IX. Purposes for making a speech

A. To inform

B. To entertain

C. To persuade

X. Basic parts of a speech

A. Introduction

B. Discussion

C. Conclusion

XI. Three "ups" of speech delivery

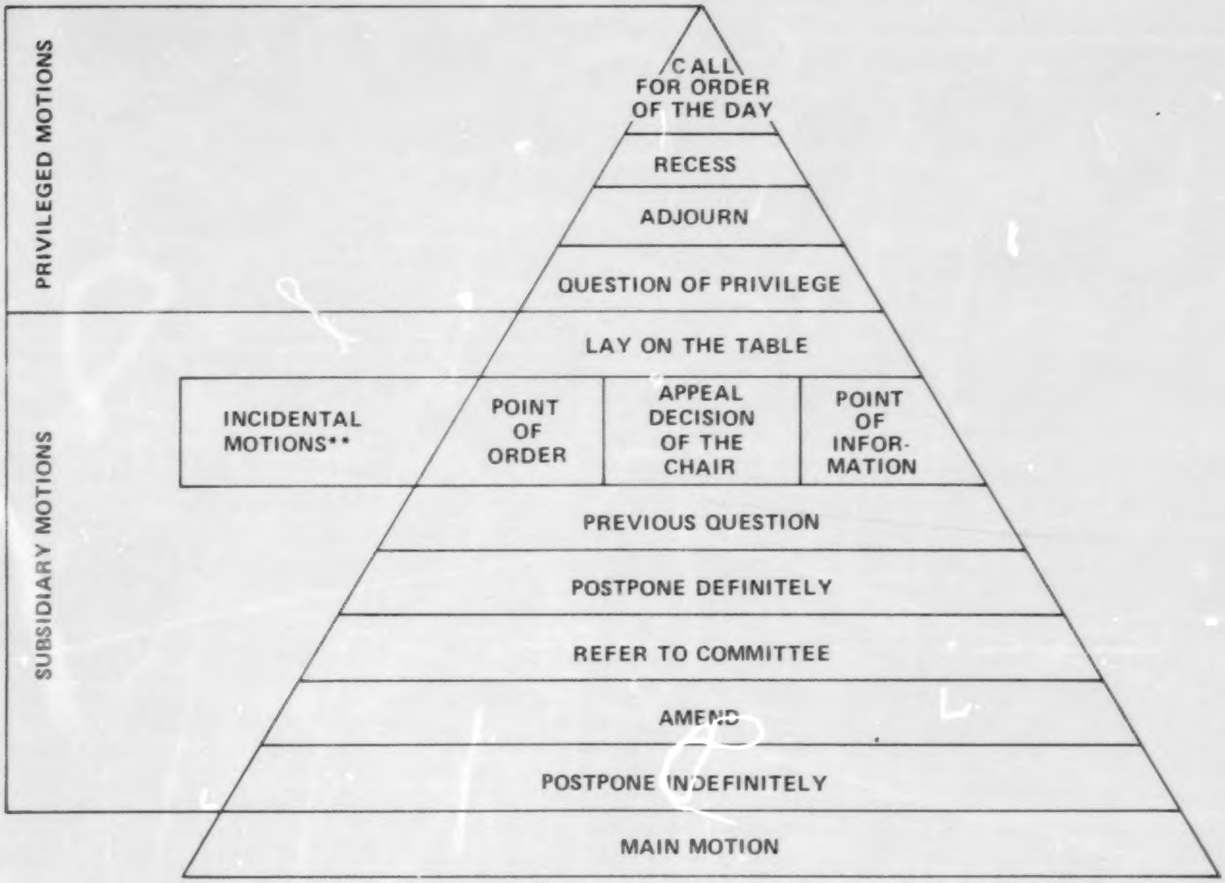
A. Stand up (avoid leaning on podium)

B. Speak up

C. Shut up (short conclusion)

Precedence* of Common Motions

When any motion is pending, you cannot introduce a motion below it. You can introduce one above it.


PRIVILEGED MOTIONS
SUBSIDIARY MOTIONS
CALL FOR ORDER OF THE DAY
RECESS
ADJOURN
QUESTION OF PRIVILEGE
LAY ON THE TABLE
INCIDENTAL MOTIONS**
POINT OF ORDER
APPEAL DECISION OF THE CHAIR
POINT OF INFORMATION
PREVIOUS QUESTION
POSTPONE DEFINITELY
REFER TO COMMITTEE
AMEND
POSTPONE INDEFINITELY
MAIN MOTION

*Order of importance

**Division of the House and to withdraw a motion are two incidental motions that take precedence as needed.

PARLIAMENTARY PROCEDURE AND PUBLIC SPEAKING
UNIT I

ASSIGNMENT SHEET #1--CONDUCT A MEETING

Conduct a business meeting to accomplish the following business under the stated conditions. Students not in the role play may want to try listing the main, subsidiary, incidental, and privileged motions used. Refer to the information sheet if necessary.

FIRST MEETING

1. Suspend the rules that all changes in the constitution and by-laws must be submitted in writing 30 days in advance.
2. Motion to add the office of president-elect to the constitution.
3. Question who would take office if the president could not complete his/her term, the president-elect or vice-president.
4. Question why you need a president-elect.
5. Question who would go with the president as a voting delegate to the regional conference, the new president-elect or vice-president
6. Elect a chairman for the auditing committee.
7. Introduce a guest speaker.
8. Motion to adjourn.

SECOND MEETING

1. Motion to commend the previous year's officers for doing a good job.
2. Raise a question of privilege to turn heat down in room.
3. Motion to take from table the motion to have a dance in April.
4. Motion on dance in April.
5. Amend motion to have dance in May.
6. Call for division of house.
7. Point of information on exact date of dance.
8. Motion to have a country-western band instead of a rock band.

ASSIGNMENT SHEET #1

9. Debate the kind of band.
10. Withdraw the motion to have a country-western band without any objections.
11. Motion to adjourn.

THIRD MEETING

1. Motion to raise dues $1.00.
2. Discuss need to cover additional costs of annual banquet, travel expenses to conferences, and printing costs for newsletters.
3. Discuss alternative methods, such as fund raising or each member covering her/his own expenses.
4. Refer the motion to committee.
5. Motion to participate in the Red Cross fund drive.
6. Lay on table until more information can be obtained about Red Cross fund drive.
7. Have a motion to participate in the United Way fund drive before the Red Cross drive motion has been resolved, followed by a point of order.
8. Motion to adjourn.

PARLIAMENTARY PROCEDURE AND PUBLIC SPEAKING
UNIT I

TEST

NAME ______________________________ SCORE ____________

1. Name the principles upon which parliamentary procedure is based.

   a. ______________________________

   b. ______________________________

2. Select from the list below the characteristics of a good chairman. Place an "X" in the appropriate blanks.

   ______a. Is partial to certain individuals and groups

   ______b. Inspires confidence in the members

   ______c. Is a good follower

   ______d. Asks if there are any additions and/or corrections to the minutes

   ______e. Repeats motions and amendments exactly as they were stated before voting

3. Arrange in order the suggested order of business. Place a "1" in front of the first step, a "2" in front of the second, and so on.

   ______a. Committee reports

   ______b. Special program of a serious nature

   ______c. Meeting called to order

   ______d. Meal (if a meal function)

   ______e. Treasurer's report

   ______f. Reading minutes of previous meeting and taking roll

   ______g. Adjournment

   ______h. Unfinished business

   ______i. Program

   ______j. Announcements, introductions, correspondence, awards, or closing ceremony _____k. New business

_____l. Refreshments and recreation

4. Select from the list below those things that make a good meeting. Place an "X" in the appropriate blanks.

_____a. Advanced planning and practice by the executive committee

_____b. Arranging the seating plan so everyone can see the program

_____c. Proceeding according to the chairman's wishes

_____d. Conducting business according to parliamentary procedure

_____e. Preparing written and oral committee's, secretary's, and treasurer's reports

_____f. Waiting thirty minutes for latecomers in order to begin meeting

_____g. Moving along with "snap" to prevent boredom and wasted time

_____h. All members expressing appreciation to guests for their attendance

_____i. All members being involved in all committees

_____j. Proceeding with maximum participation by the advisor(s)

_____k. Helping with any clean-up duties

_____l. Having an official greeter to make everyone feel welcome and to prevent interruptions of serious portions of the meeting

_____m. Giving the guest speaker some indication of the topic desired and the length of the speech

5. Describe the proper way to introduce a motion.

____

____

____

____

____

____

6. Match categories of motions on the right to their correct definitions. Place the appropriate numbers in the blanks provided.

______a. To act upon questions of great importance which have no connection with the main motion

______b. To change or amend the main motion under consideration

______c. To introduce business for the assembly's action

______d. To answer questions arising from the business procedures being conducted

1. Main motion
2. Subsidiary motion
3. Privileged motion
4. Incidental motion

7. Select from the list below true statements about the characteristics of various kinds of motions. Place an "X" in the appropriate blanks.

______a. A motion to amend is an effort to improve the motion or amendment through additions, deletions, or corrections

______b. To call for the previous question means further debate is desired before a vote is taken

______c. To lay on the table means you want to wait awhile before discussing the issue further

______d. To commit or refer to committee is a way of giving more careful consideration and study to a subject before a vote is taken

______e. To limit or extend time for debate shortens or lengthens the discussion period

______f. To postpone indefinitely prevents a vote on the question

______g. A friendly amendment allows a motion or amendment to be changed without the approval of the person making the motion or amendment

______h. A motion to adjourn is a privileged motion

______i. A motion to take a recess delays action by providing a break in the business meeting

______j. To raise a question of privilege allows the speaker longer debate time

______k. To call for the order of the day means you disagree with what is being done and want to return to the order of business instead ______l. To raise a point of order means room conditions are bothering you

______m. To raise a point of order is to call attention to a violation of rules according to parliamentary procedure

______n. To suspend the rules is illegal and not possible under parliamentary procedure

______o. To call for a division is a way to check the accuracy of a voice vote or to secure expression of individual member's vote

______p. To call for a division secures an accurate check on a vote through some visible means, such as raising hands, standing, or taking a roll call vote

______q. Parliamentary inquiry or point of information has the purpose of obtaining information about the issue or business procedure

______r. To appeal the decision of the chair means you get the group's opinion rather than depending on the chair's judgment alone

______s. The purpose of a motion to open or close nominations for an office is to stop or add more candidates

______t. A motion to take from the table allows further discussion by bringing back the issue that has been tabled for further discussion

8. Select from the list below true statements about basic rules for parliamentary procedure. Place an "X" in the appropriate blanks.

______a. Member is not allowed to change vote

______b. All members are required to vote

______c. All blank ballots or members not voting are considered in determining quorum, majority, two-thirds, or unanimous vote

______d. Candidate for a position should never be elected by plurality vote (receiving the largest vote of any candidate), but candidates receiving low votes must be eliminated until one candidate receives a majority vote

______e. Motion or amendment may not be broken down into parts but the motion or amendment must be voted upon as a whole

______f. No member should be allowed to discuss an issue a second time unless all members have had an opportunity to speak

______g. First speaker in a debate or discussion should be allowed to make the final statement before discussion is closed

9. List the purposes for making a speech.

   a. ____

   b. ____

   c. ____

10. List the basic parts of a speech.

   a. ____

   b. ____

   c. ____

11. List the three "ups" of speech delivery.

   a. ____

   b. ____

   c. ____

12. Conduct a meeting.

   (NOTE: If the above activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

PARLIAMENTARY PROCEDURE AND PUBLIC SPEAKING
UNIT I

ANSWERS TO TEST

1. a. Right of the majority to rule

   b. Right of the minority to be heard and protected

2. b, d, e

3.

a.	6	g.	11
b.	2	h.	7
c.	1	i.	9
d.	3	j.	10
e.	5	k.	8
f.	4	l.	12

4. a, b, d, e, g, h, k, l, m

5. Description should include:

   a. Have only one main motion on the floor at a time

   b. Receive recognition by the chair before speaking

   c. Stand and address the chair as "Mr. Chairman" or "Madame Chairman"

   d. Say "I move . . ."; do not say "I make a motion . . ." or "I move that . . ."

   e. Word all motions in a positive way so that a "yes" vote means the membership is in favor of the proposed motion

6. a. 3

   b. 2

   c. 1

   d. 4

7. a, c, d, e, f, h, i, k, m, o, p, q, r, s, t

8. d, f, g

9. a. To inform
   b. To entertain
   c. To persuade
10. a. Introduction
    b. Discussion
    c. Conclusion
11. a. Stand up (avoid leaning on podium)
    b. Speak up
    c. Shut up (short conclusion)
12. Evaluated to the satisfaction of the instructor

BECOMING A GOOD LEADER
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to list reasons for becoming a good leader and select ways to demonstrate leadership potential. The student should complete the personality self-rating scale to determine how she/he rates as a leader and select leaders within the community. This knowledge will be evidenced by completion of the assignment sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Define *leadership.*
2. List the reasons for becoming a good leader.
3. Name the steps in becoming a good leader.
4. Select from a list ways to demonstrate leadership potential.
5. Select from a list statements about how a leader gives orders, instructions, and directions most effectively.
6. Rate self as a leader after completing personality self-rating scale.
7. Select leaders within community.

BECOMING A GOOD LEADER
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information and assignment sheets.

  C. Discuss unit and specific objectives.

  D. Discuss information and assignment sheets.

  E. Help evaluate the student according to Assignment Sheet #1.

  F. Invite representatives from various construction companies to form a panel discussion about their organizations' goals, projects, and structure and about the leadership skills that are needed in their types of organizations.

  G. Have students prepare questions to ask guest speakers.

  H. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Leadership

    2. TM 2--Traits of a Good Leader

  D. Assignment sheets

    1. Assignment Sheet #1--Personality Self-Rating Scale

    2. Assignment Sheet #2--Select Leaders Within Your Community

  E. Test

  F. Answers to test

III. Unit references:

  A. *Official Manual.* Alexandria, Virginia: Future Farmers of America, 1971.

B. Gray, Jarrell D., and **Jackson, J. R.** *Leadership and Training Parliamentary Procedure for FFA.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1958.

C. *Animal Science.* Columbia, Missouri: Missouri State Department of Education, Agricultural Education Section, University of Missouri.

BECOMING A GOOD LEADER
UNIT II

INFORMATION SHEET

I. Leadership--Combination of qualities which inspires confidence, draws others toward the leader, and causes them to follow willingly (Transparency 1)

(NOTE: A leader may or may not be the same person who has been granted the authority to carry out the duties of an organization.)

II. Reasons for becoming a good leader

A. Gives one a feeling of self-satisfaction

B. Provides a skill which is needed in all fields

C. Is a challenge to learn leadership skills

D. Creates respect for others

E. Helps individual to mature

III. Steps in becoming a good leader

(NOTE: Leaders are made, not born.)

A. Study qualities of a good leader

B. Evaluate weak and strong points in yourself

C. Become a good follower

(NOTE: It is important to become a good follower before becoming a good leader.)

D. Develop a plan for training yourself as a leader

IV. Ways to demonstrate leadership potential (Transparency 2)

A. Be willing to assume responsibility

(NOTE: It is important to assume responsibility both as a leader and as a follower. Some people will not assume responsibility unless they can be a leader.)

B. Be honest and above reproach

(NOTE: Operate so your honesty is not even questionable.)

INFORMATION SHEET

C. Be loyal to the firm or organization

(NOTE: Avoid gossip and unconstructive criticism.)

D. Be energetic and enthusiastic

(NOTE: To be enthusiastic you must act enthusiastically. The action is often necessary before the feeling can occur.)

E. Be able to think for yourself and make decisions

(NOTE: Do not say, "What do you want to do?" "I don't know. What do you want to do?" "I don't care, whatever you want to do.")

F. Be mentally alert

G. Cooperate with co-workers and authority figures

H. Show genuine concern for others at all times

I. Be diplomatic and tactful

J. Stick to a job when the going gets rough

K. Be self-confident and poised

(NOTE: Know your abilities and limitations, but be honest. Are your limitations absolutely ones which you cannot work around somehow?)

L. Be open minded, optimistic, and progressive

(NOTE: Avoid being negative.)

M. Be able to accept and give constructive criticism

N. Analyze facts before jumping to conclusions

O. Be able to express yourself effectively

P. Take pride in doing a good job

Q. Believe in the goals of the organization

R. Be able to give others credit for their contributions to the organization

S. Encourage and motivate members of the group through actions and examples

INFORMATION SHEET

T. Be a good listener

U. Be patient

V. Be fair and impartial

W. Express appreciation for work well done

X. Know how to solve problems systematically

Y. Have faith in people and a desire to work with them

Z. Plan the program of work, set priorities, and plan time schedules so tasks are accomplished quickly

AA. Be sensitive to individuals and recognize differences

BB. Have a sense of humor

(NOTE: Be able to laugh at yourself.)

CC. Realize that your responsibility is to let others share the responsibilities through delegation of duties

DD. Provide a pleasant and adequate working environment

EE. Check and double check to see that all delegated tasks have been accomplished satisfactorily

FF. Use the talents of each person in the group or organization to the fullest potential

GG. Set realistic goals

HH. Be as persistent and aggressive as necessary

II. Have alternative plans of action

JJ. Show self-control or self-discipline

V. How a leader gives orders, instructions, and directions most effectively

A. Give information in a clear manner

(NOTE: Prepare in advance how to give the information in the best possible way.)

1. Repeat orders politely if asked to do so
2. Give examples and demonstrations
3. Number or letter steps

INFORMATION SHEET

B. Avoid unnecessary details

C. Give complete information

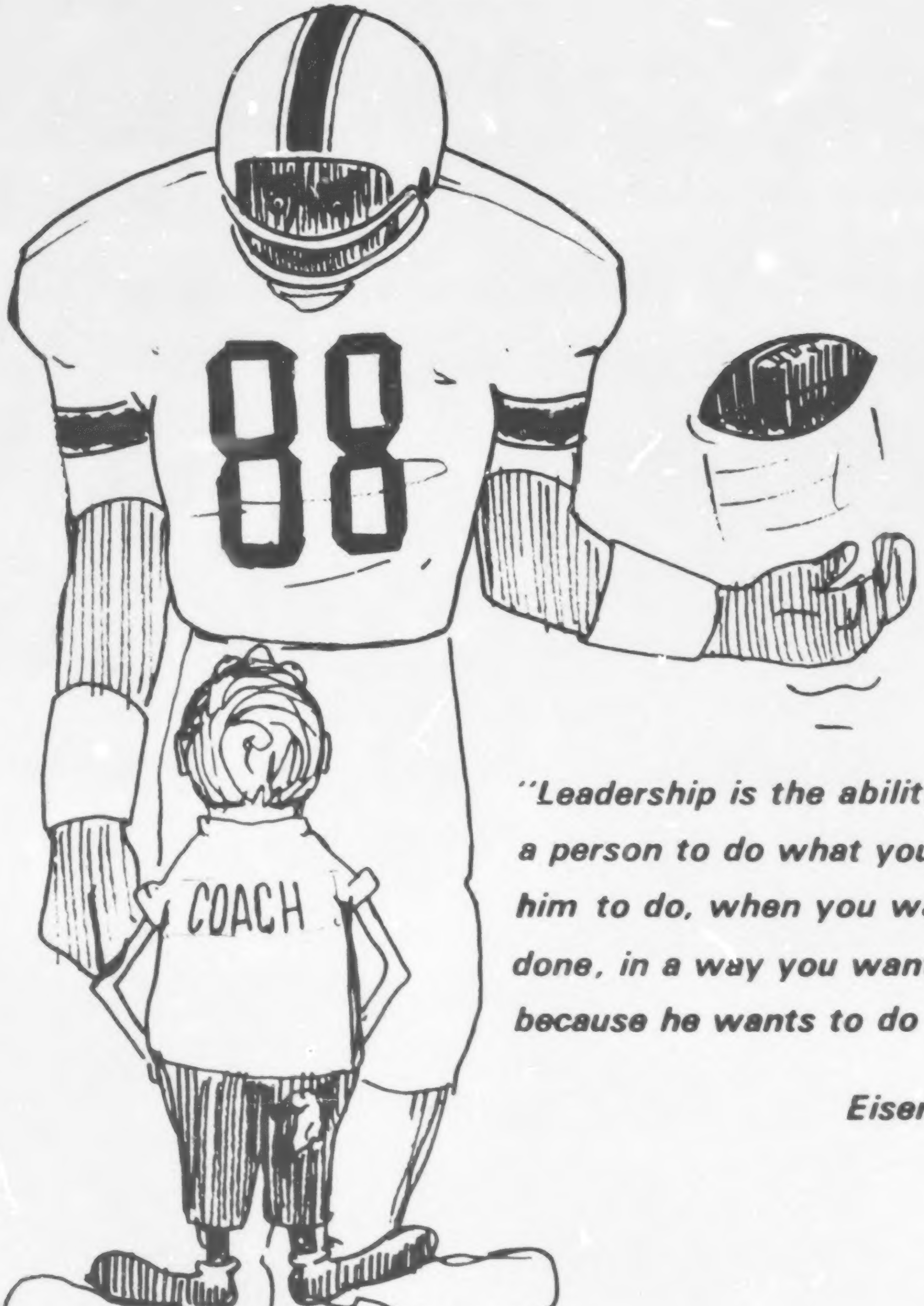
   1. Who
   2. What
   3. When
   4. Where
   5. Why

D. Give the standard of excellence needed

E. State information in a positive way

F. Summarize and repeat important points periodically

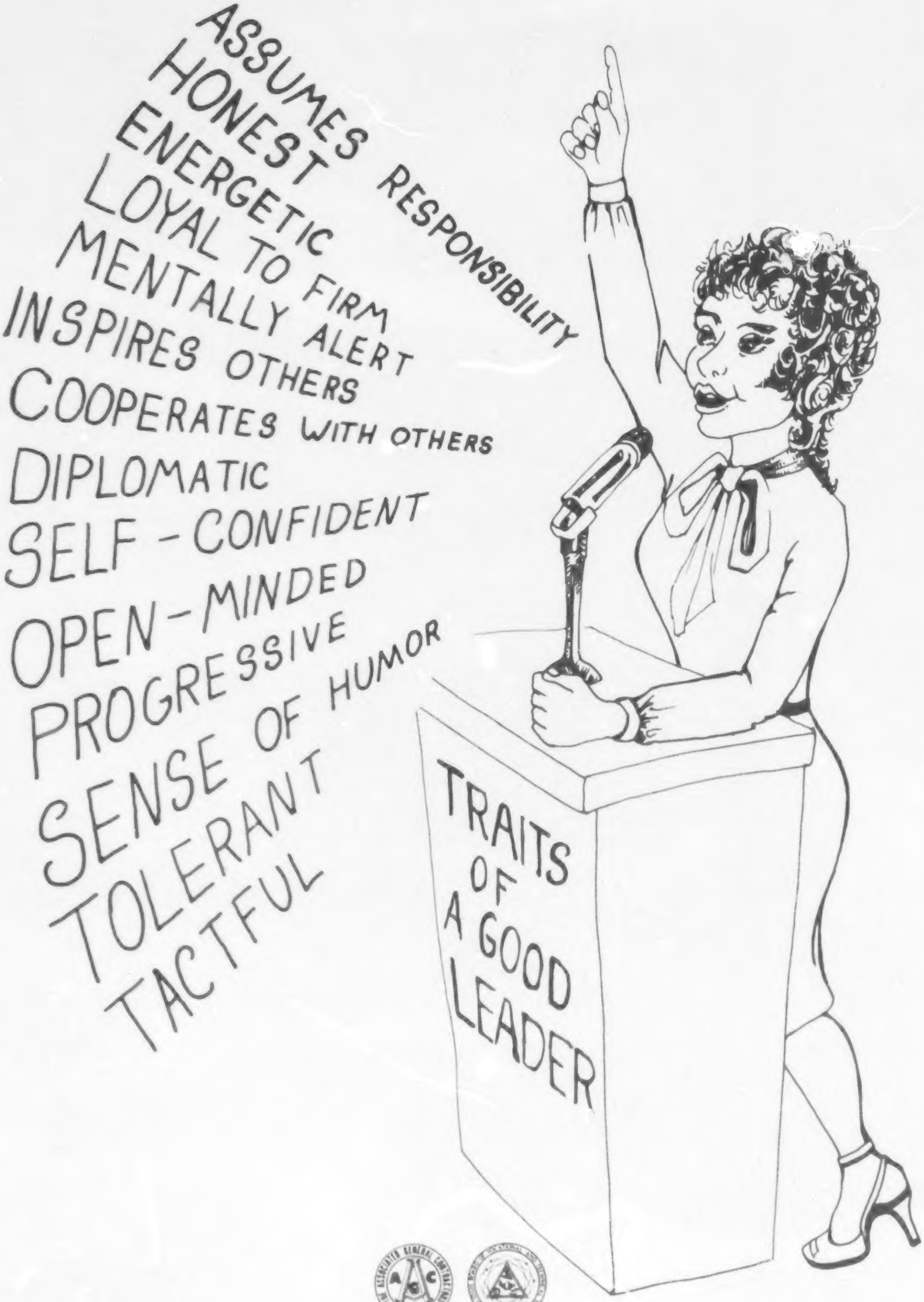
Leadership



"Leadership is the ability to get a person to do what you want him to do, when you want it done, in a way you want it done, because he wants to do it."

Eisenhower

Traits of a Good Leader


ASSUMES RESPONSIBILITY
HONEST
ENERGETIC
LOYAL TO FIRM
MENTALLY ALERT
INSPIRES OTHERS
COOPERATES WITH OTHERS
DIPLOMATIC
SELF-CONFIDENT
OPEN-MINDED
PROGRESSIVE
SENSE OF HUMOR
TOLERANT
TACTFUL
TRAITS OF A GOOD LEADER

BECOMING A GOOD LEADER
UNIT II

ASSIGNMENT SHEET #1--PERSONALITY SELF-RATING SCALE

Circle the appropriate number following each trait. Four is outstanding; three is above average; two is average; one is poor. Total your score on the following page. You may then want a person in your class to rate you to see if the evaluations are the same.

PART A

		Poor	Average	Above Average	Outstanding
1.	Do I maintain a well-groomed appearance?	1	2	3	4
2.	Do I have a pleasing voice?	1	2	3	4
3.	Is my posture alert and poised?	1	2	3	4
4.	Is my disposition cheerful?	1	2	3	4
5.	Do I make friends easily?	1	2	3	4
6.	Do I exert positive leadership?	1	2	3	4
7.	Am I generally thoughtful of the feelings of others?	1	2	3	4
8.	Is my enthusiasm sincere and contagious?	1	2	3	4
9.	Do I persevere until I achieve success?	1	2	3	4
10.	Am I sincere in my interest in other people?	1	2	3	4
11.	Am I ambitious to get ahead?	1	2	3	4
12.	Do I get along well with others?	1	2	3	4
13.	Do I react constructively to criticism?	1	2	3	4
14.	Do I remember names and faces?	1	2	3	4
15.	Am I punctual on all occasions?	1	2	3	4
16.	Do I have and evidence a spirit of cooperation?	1	2	3	4

ASSIGNMENT SHEET #1

		Poor	Average	Above Average	Outstanding
17.	Am I free from prejudice?	1	2	3	4
18.	Do I know how people react in most situations?	1	2	3	4
19.	Am I generally a good listener?	1	2	3	4
20.	Do I refuse to be hurt by what other people say?	1	2	3	4
21.	Can I criticize without giving offense?	1	2	3	4
22.	Do I usually like people for what they are, or do I wait to see if they like me?	1	2	3	4
23.	Do I enjoy being part of a group?	1	2	3	4
24.	Am I reliable?	1	2	3	4
25.	Can I adapt myself to all situations?	1	2	3	4
26.	Am I easily discouraged?	1	2	3	4
27.	Do I apply myself to the problems of each day?	1	2	3	4
28.	Can I make a decision quickly and accurately?	1	2	3	4
29.	Am I loyal to my supervisors and associates?	1	2	3	4
30.	Do I try to get the other person's point of view?	1	2	3	4
31.	Am I neat and clean in my work?	1	2	3	4
32.	Do I know where I make my mistakes, and do I admit them?	1	2	3	4
33.	Am I looking for opportunities to serve others better?	1	2	3	4
34.	Am I following a systematic plan for improvement and advancement?	1	2	3	4
35.	Can I accept honors and advancements and yet keep my feet on the ground?	1	2	3	4

ASSIGNMENT SHEET #1

	Poor	Average	Above Average	Outstanding
36. Am I playing the game of life honestly and fairly with myself and with others?	1	2	3	4

Total Score ____________

Now evaluate your score. If your score totaled over 100, your personality rating is superior. If you have been honest with yourself, you are among the people who are most likely to succeed. A score of 90-100 is above average; 75-90 is average; below 75 shows plenty of room for improvement. How did you rate?

PART B

Divide into small groups now and discuss why these characteristics are important and how to eliminate any problem areas. This can be a very valuable experience if you will use it well.

BECOMING A GOOD LEADER
UNIT II

ASSIGNMENT SHEET #2--SELECT LEADERS WITHIN YOUR COMMUNITY

1. Select three individuals in your local community who appear to you to be good leaders. After you have selected the leaders, list three leadership qualities that you believe each individual possesses.

    a. ______________________ 1) ______________________
    2) ______________________
    3) ______________________

    b. ______________________ 1) ______________________
    2) ______________________
    3) ______________________

    c. ______________________ 1) ______________________
    2) ______________________
    3) ______________________

2. Now, can you see any common leadership qualities that the individuals possess? If so, what are they?

    ____
    ____
    ____
    ____

3. How can you use these leadership qualities on your job?

    ____
    ____
    ____
    ____
    ____

BECOMING A GOOD LEADER
UNIT II

TEST

NAME ______________________________ SCORE ____________

1. Define *leadership.*

____

____

2. List two reasons for becoming a good leader.

a. ______________________________

b. ______________________________

3. Name the steps in becoming a good leader.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

4. Select from the list below ways to demonstrate leadership potential. Place an "X" in the correct blanks.

______a. Be willing to assume responsibility

______b. Do not do anything until you are told to do it

______c. Be honest and above reproach

______d. Be loyal to the firm or organization

______e. Be energetic and enthusiastic

______f. Rely on other people to make the decisions

______g. Be mentally alert

______h. Set realistic goals

______i. Cooperate with co-workers and authority figures

______j. Show genuine concern for others at all times ______k. Be diplomatic and tactful

______l. Quit trying when the going gets rough

______m. Be open-minded, optimistic, and progressive

______n. Be pessimistic

______o. Do something a certain way because it has always been done that way

______p. Make quick, snap decisions in most cases

______q. Take pride in doing a good job

______r. Believe in the goals of the organization

______s. Be able to accept and give constructive criticism

______t. Be able to give others credit for their contributions to the organization

5. Select from the list below statements about how a leader gives orders, instructions, and directions most effectively. Place an "X" in the correct blanks.

    ______a. Repeat orders politely if asked to do so

    ______b. Give examples and demonstrations

    ______c. Provide a lot of details

    ______d. Give complete information, including who, what, when, where, and why

    ______e. Give the standard of excellence needed

    ______f. State information in a negative manner

6. Rate self as a leader after completing personality self-rating scale.

7. Select leaders within community.

    (NOTE: If activities six and seven have not been accomplished prior to the test, ask your instructor when they should be completed.)

BECOMING A GOOD LEADER
UNIT II

ANSWERS TO TEST

1. Combination of qualities which inspires confidence, draws others toward the leader, and causes them to follow willingly
2. Any two of the following:
    a. Gives one a feeling of self-satisfaction
    b. Provides skill which is needed in all fields
    c. Is a challenge to learn leadership skills
    d. Creates respect for others
    e. Helps individual to mature
3. a. Study qualities of a good leader
    b. Evaluate weak and strong points in yourself
    c. Become a good follower
    d. Develop a plan for training yourself as a leader
4. a, c, d, e, g, h, i, j, k, m, q, r, s, t
5. a, b, d, e
6. Evaluated to the satisfaction of the instructor
7. Evaluated to the satisfaction of the instructor

COMMERCIAL CARPENTRY

PROGRESS CHART

Section B
Leadership

	UNIT I PARLIAMENTARY PROCEDURE AND PUBLIC SPEAKING			UNIT II BECOMING A GOOD LEADER																
	1	2	3	1	2	3														
Job	UNIT TEST	Conduct a Meeting		UNIT TEST	Personality Self-Rating Scale	Select Leaders Within Your Community														
Student's Name																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy	85% Correct	85% Correct		85% Correct	85% Correct	85% Correct														
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

[redacted]

Section C
Related Information

LUMBER
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to match the types of softwood lumber to their grades and write a bill of materials for ordering lumber. The student should be able to list the methods of drying lumber, identify the common defects in lumber, and compute board feet and cost. This knowledge will be evidenced by completion of the assignment sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match the types of softwood lumber to their grades.
2. Match letters designating veneers used in fir plywood to their correct descriptions.
3. List the standard fir plywood grades by face veneer.
4. Write a bill of materials for ordering lumber.
5. List the major methods used in sawing lumber.
6. List the methods of drying lumber.
7. Identify common lumber defects.
8. Compute board feet and cost.

LUMBER
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

- A. Provide students with objective sheet.
- B. Provide students with information sheet.
- C. Make transparencies.
- D. Discuss unit and specific objectives.
- E. Discuss information sheet.
- F. Provide students with assignment sheets.
- G. Demonstrate and discuss steps outlined in assignment sheets.
- H. Give test.

II. Instructional materials:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
  - 1. TM 1--Lumber Grading
  - 2. TM 2--Minimum Bending Radii
  - 3. TM 3--Plywood Grades and Grade Trademarks
  - 4. TM 4--Plywood Grades and Grade Trademarks (Continued)
  - 5. TM 5--Methods of Sawing Lumber
  - 6. TM 6--Lumber Defects
- D. Assignment sheets
  - 1. Assignment Sheet #1--Compute Board Feet
  - 2. Assignment Sheet #2--Compute the Cost of Materials

E. Answers to assignment sheets

F. Test

G. Answers to test

III. Unit references:

A. Burbahn, Walter E. *Fundamentals of Carpentry.* 4th ed. Chicago, Illinois: American Technical Society, 1967.

B. Feirer, John L. *Cabinetmaking and Millwork.* Peoria, Illinois: Charles A. Bennett Company, Inc., 1967.

C. Feirer, John L. *Woodworking for Industry.* Peoria, Illinois: Charles A. Bennett Company, Inc., 1971.

D. Hackett, Donald F., and Spielman, Patrick E. *Modern Wood Technology.* Milwaukee, Wisconsin: The Bruce Publishing Company, 1968.

E. Wagner, Willis H. *Modern Carpentry.* Homewood, Illinois: Goodheart-Willcox Company Inc., 1969.

LUMBER
UNIT I

INFORMATION SHEET

I. Grading of softwood lumber (Transparency 1)

- A. Yard lumber--Boards 1" - 1 1/2" thick, 2" and wider
  - 1. Finish grades
    - a. B and better
    - b. C select
    - c. D select
  - 2. Common grades
    - a. No. 1 common
    - b. No. 2 common
    - c. No. 3 common
    - d. No. 4 common
- B. Framing grades
  - 1. Dimension--2" - 5" thick, 2" and wider
  - 2. Timbers--5" and thicker, 5" and wider
  - 3. West coast douglas fir
    - a. Select
    - b. Construction
    - c. Standard
    - d. Utility
    - e. Economy
  - 4. Southern pine
    - a. No. 1
    - b. No. 2
    - c. No. 3

INFORMATION SHEET

II. Letters designating veneers used in fir plywood (Transparencies 2, 3,and 4)

  A. N--Intended for natural finish; select all heartwood free from all open defects; may contain few repairs if well matched

  B. A--Smooth, paintable, well jointed; permits neatly made repairs

  C. B--Relatively smooth; permits circular repair plugs; small tight knots

  D. C--Minimum veneer permitted in exterior-type; knotholes up to 1"; splits, tight knots, shims, and sanding defects

  E. C (plugged)--Improved C

  F. D--Permits knots and knotholes to 2 1/2" in width and 1/2" larger under certain specified limits; limited splits permitted

III. Standard fir plywood grades (Transparencies 2, 3,and 4)

  A. Interior by face veneer

    1. AA

    2. AB

    3. AC

    4. BB

    5. BC

    6. CC

    7. CD

  B. Exterior by face veneer

    1. AA

    2. AB

    3. AD

    4. BB

    5. BD

    6. CD

INFORMATION SHEET

7. BB plyform

8. HDO plyform

IV. Ordering lumber

A. Lumber measurements as a purchasing unit

1. Board foot--Strip lumber, boards, dimension lumber, structural timbers, and shop lumber

2. Square foot--Plywood, particle board, and hardboard

3. Lineal foot--Molding and trim

B. Specifications

1. Number of pieces

2. Thickness

a. Lumber sold by the board foot

(NOTE: One-half inch and thicker is designated as the next full inch; for example, three-fourths inch is listed as one inch.)

b. Lumber sold by the square foot

(NOTE: The exact thickness must be specified.)

c. Material sold by the lineal foot

(NOTE: The exact dimensions must be given.)

3. Width

a. Width of softwood lumber sold by the board foot is specified in even inches

Examples: 2", 4", 6", 8", 10", 12"

b. Exact width of lumber sold by the square foot must be specified; this material is usually produced in four-foot widths, unless specially ordered

4. Length

(NOTE: The length of softwood lumber sold by the board foot is specified in even feet, usually up to twenty-four feet.)

INFORMATION SHEET

5. Grade

6. Kind of lumber

7. Face preparation

(NOTE: Yard lumber is generally surfaced on four sides and crosscut to length.)

C. Bill of materials for ordering lumber

1. Yard lumber

	Number of pieces	Thickness	Width	Length	Grade	Species	Drying
a.	6 -	2" x	4" x	14'	utility,	fir,	KD
b.	4 -	1" x	8" x	16'	economy,	fir,	KD

2. Plywood

	Number of pieces	Thickness	Width	Length	Grade	Species	
a.	4 sheets	3/4" x	4' x	8'	AB,	fir,	INT.
b.	2 sheets	1/4" x	4' x	8'	AC,	fir,	EXT.

V. Major methods used in sawing lumber (Transparency 5)

A. Quarter sawed

B. Plain sawed or flat-sawed

VI. Methods of drying lumber

A. Air-dried

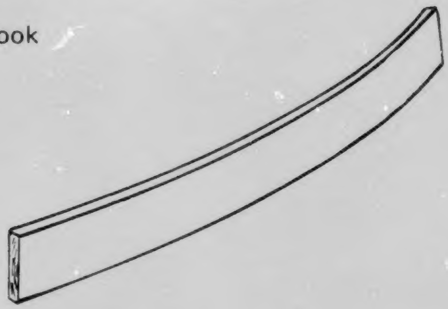
B. Kiln-dried

INFORMATION SHEET

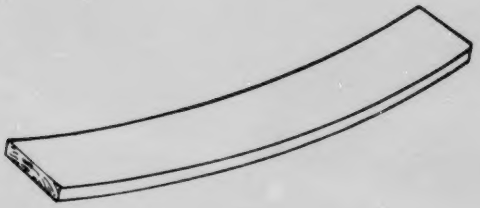
VII. Common defects in lumber (Transparency 6)

(NOTE: Crook, bow, cup, and twist or wind are referred to as warp.)

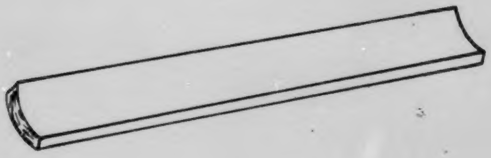
A. Crook



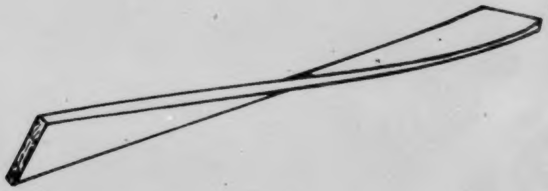
B. Bow



C. Cup

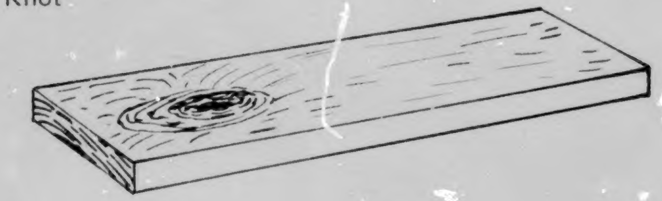


D. Twist or wind

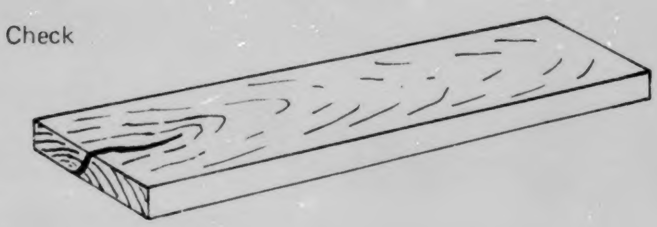


INFORMATION SHEET

E. Knot



F. Check



VIII. Computing board feet and cost (Assignment Sheet #1)

A. Board foot is 1 inch thick, 12 inches wide, and 1 foot long or the equivalent 1" x 12" x 1'

B. In the formula, *N* means number of pieces, *T* means thickness in inches, *W* means width in inches, and *L* means length in feet

$$\frac{N \times T \times W \times L}{12} = \text{Board Feet}$$

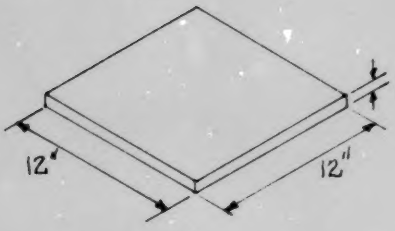
C. Lumber sizes used in figuring board feet are the nominal sizes; lumber less than 1" thick is figured as 1 inch

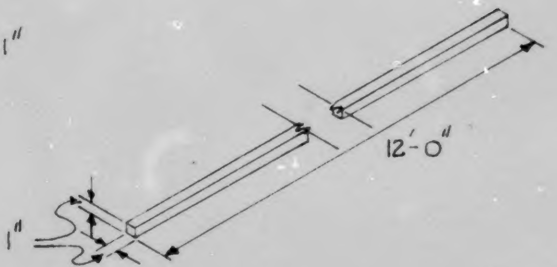
Example: A piece 1/2" x 12" x 12" is considered as one board foot. Lengths are usually in even feet under twenty-four feet; lumber over twenty-four feet can be obtained by special order

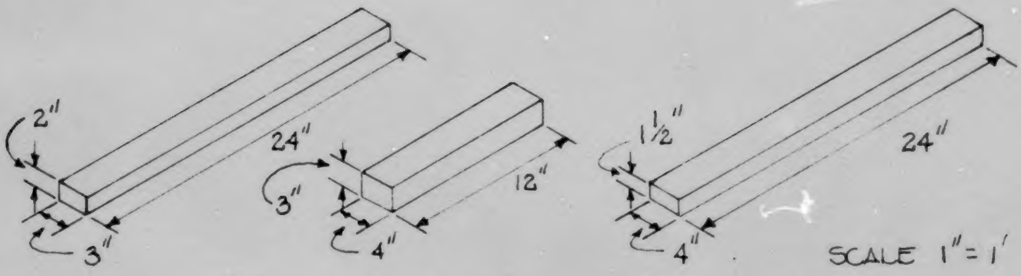
INFORMATION SHEET

D. Unit of measure for lumber is board foot

(NOTE: Each of the illustrations is one board foot.)







E. Pricing of lumber

1. Per board foot
2. Per 100 board feet

   (NOTE: Per hundred board feet is abbreviated as *per C.*)

3. Per 1000 board feet

   (NOTE: Per thousand board feet is abbreviated as *per M.*)

(NOTE: Fractional board feet are not computed but are rounded up to the nearest full board foot.)

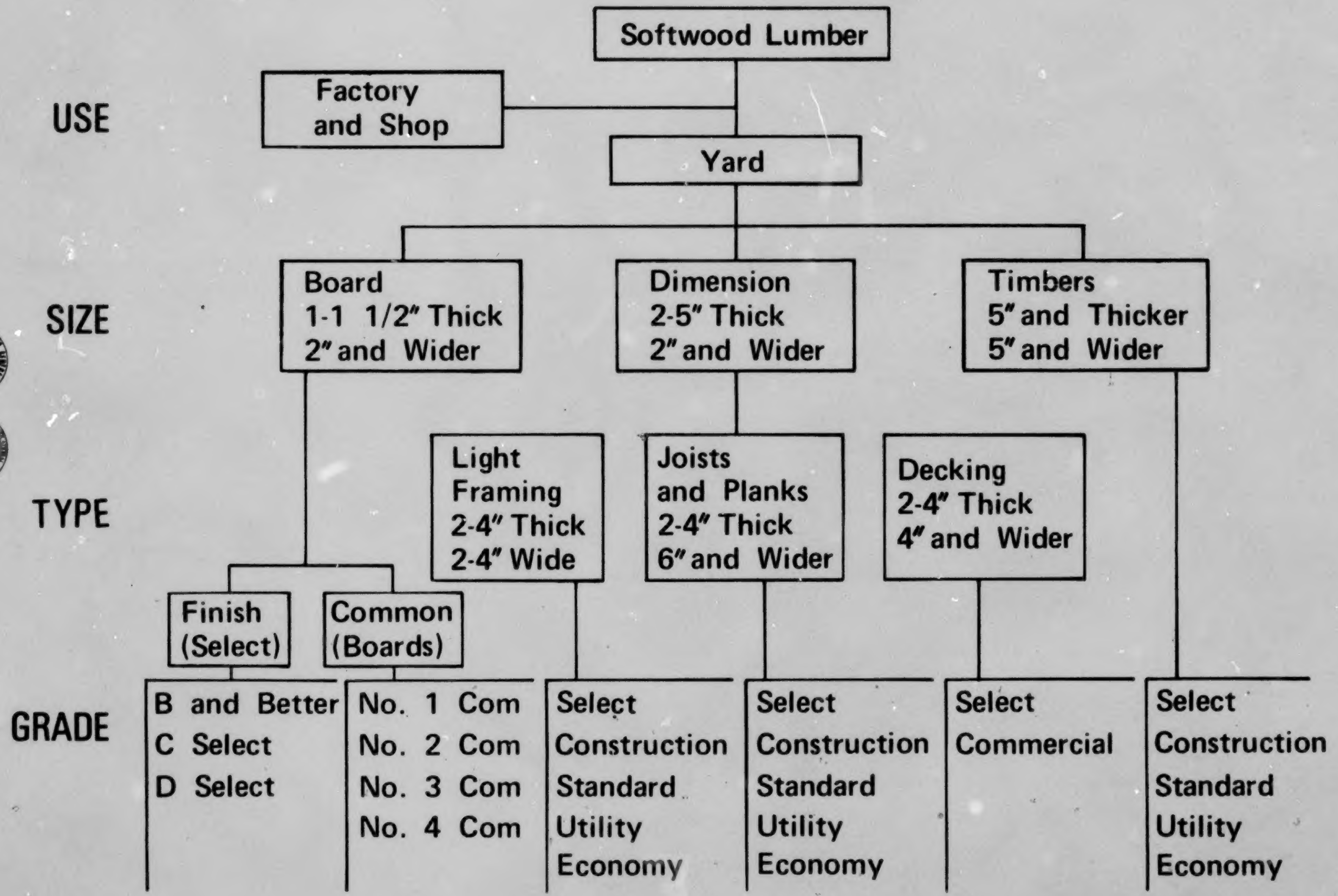
Examples: 1 1/3 board feet is called 2 board feet

1 1/2 board feet is called 2 board feet

1 3/4 board feet is called 2 board feet

1/2 board foot is called 1 board foot

Lumber Grading



USE

Softwood Lumber

Factory and Shop

Yard

SIZE

Board
1-1 1/2" Thick
2" and Wider

Dimension
2-5" Thick
2" and Wider

Timbers
5" and Thicker
5" and Wider

TYPE

Finish (Select)

Common (Boards)

Light Framing
2-4" Thick
2-4" Wide

Joists and Planks
2-4" Thick
6" and Wider

Decking
2-4" Thick
4" and Wider

GRADE

B and Better
C Select
D Select

No. 1 Com
No. 2 Com
No. 3 Com
No. 4 Com

Select
Construction
Standard
Utility
Economy

Select
Construction
Standard
Utility
Economy

Select
Commercial

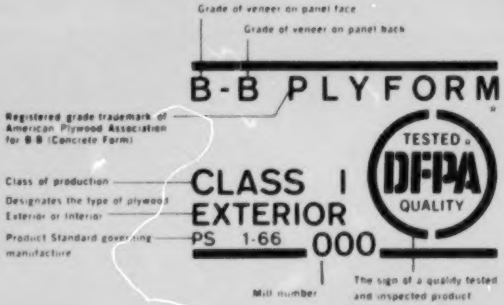
Select
Construction
Standard
Utility
Economy

Minimum Bending Radii

Plywood Thickness (in.)	Across the Grain (ft.)	Parallel to Grain (ft.)
1/4	2	5
5/16	2	6
3/8	3	8
1/2	6	12
5/8	8	16
3/4	12	20

Plywood Grades and Grade Trademarks

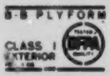
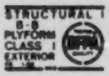
Concrete Form


Grade of veneer on panel face
Grade of veneer on panel back
B-B PLYFORM
Registered grade trademark of American Plywood Association for B-B (Concrete Form)
TESTED
DFPA
QUALITY
Class of production
CLASS I
Designates the type of plywood Exterior or Interior
EXTERIOR
Product Standard governing manufacture
PS 1-66
000
Mill number
The sign of a quality tested and inspected product

Plywood Grades and Grade Trademarks

(Continued)

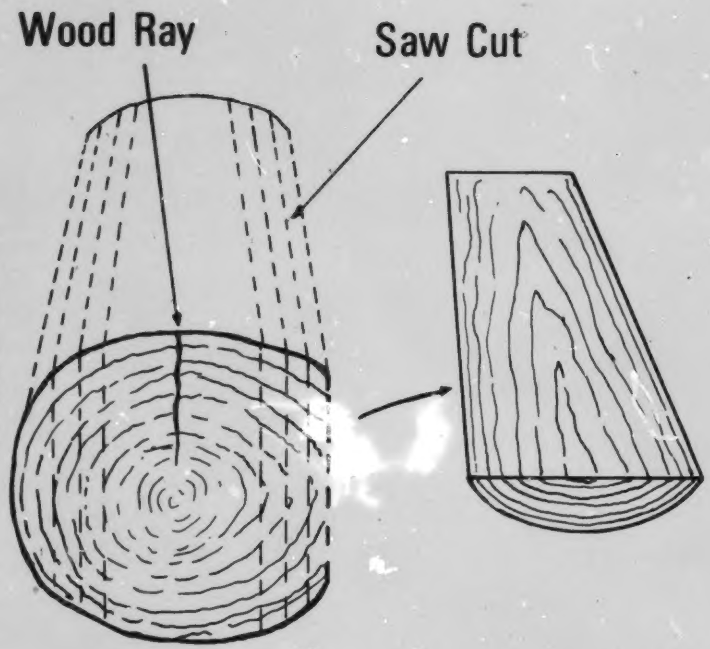
Grade-Use Guide for Concrete Forms*

Use these terms when you specify plywood	DESCRIPTION	Typical Grade-trademarks	VENEER GRADE	
			Faces	Inner Plys
B-B PLYFORM Class I & II** DFPA	Specifically manufactured for concrete forms. Many reuses. Smooth, solid surfaces. Edge-sealed. Mill-oiled unless otherwise specified.		B	C
High Density Overlaid PLYFORM Class I & II** DFPA	Hard, semi-opaque resin-fiber overlay, heat-fused to panel faces. Smooth surface resists abrasion. Up to 200 reuses. Edge-sealed. Light oiling recommended between pours.	HDO · PLYFORM I · EXT-DFPA · PS 1-66	B	C Plugged
STRUCTURAL I PLYFORM** DFPA	Especially designed for engineered applications. All Group 1 species. Stronger and stiffer than PLYFORM Class I and II. Recommended for high pressures where face grain is parallel to supports. Also available with High Density Overlay faces.	 STRUCTURAL I B-B PLYFORM CLASS I EXTERIOR DFPA	B	C or C Plugged
Special Overlays, proprietary panels and Medium Density Overlaid plywood specifically designed for concrete forming**	Produce a smooth uniform concrete surface. Generally mill treated with form release agent. Check with manufacturer for design specifications, proper use, and surface treatment recommendations for greatest number of reuses.			

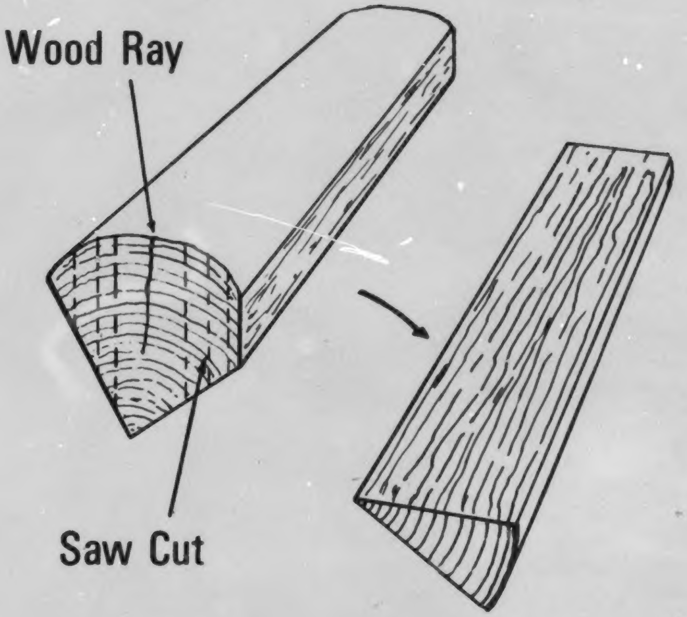
*Commonly available in 5/8" and 3/4" panel thicknesses (4'x8' size).

**Check dealer for availability in your area.

Methods of Sawing Lumber


Wood Ray
Saw Cut

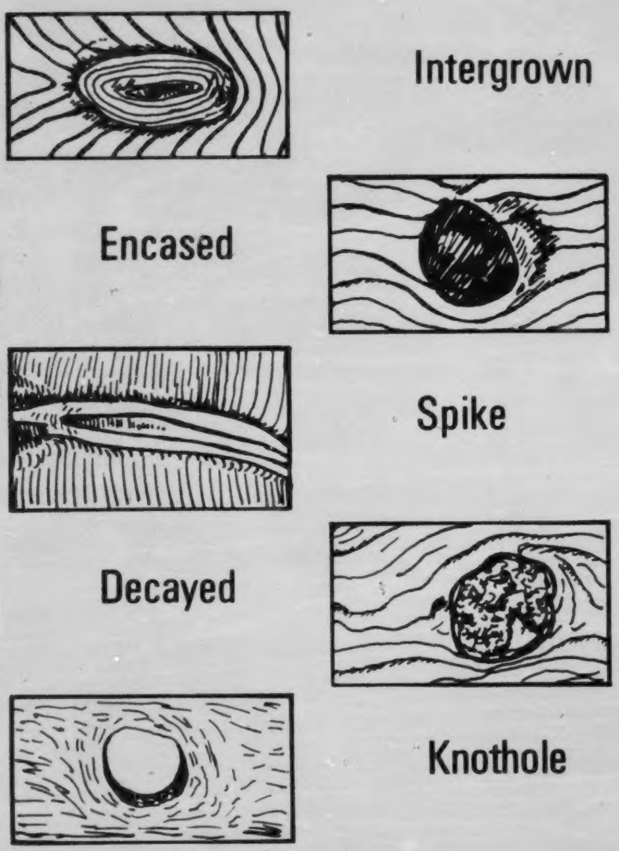
PLAIN SAWED (Flat)
Cut Tangent to Annual Rings


Wood Ray
Saw Cut

QUARTER SAWED

Lumber Defects

KINDS of Knots



Intergrown

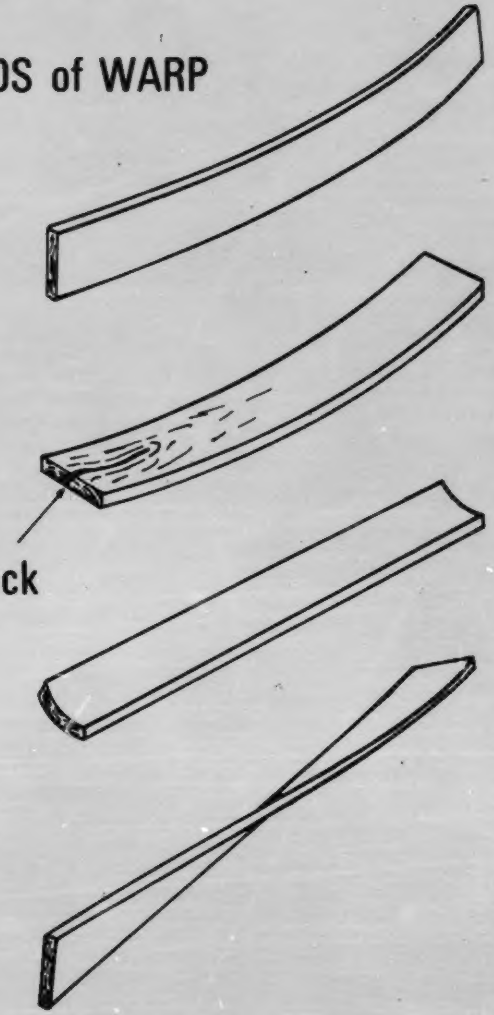
Encased

Spike

Decayed

Knothole

KINDS of WARP



Crook

Bow

Check

Cup

Twist

LUMBER
UNIT I

ASSIGNMENT SHEET #1--COMPUTE BOARD FEET

1. Compute the total board feet in each of the problems listed below, rounding off to the next foot.

Formula: $$\frac{N \times T \times W \times L}{12}$$

N = Number of pieces

T = Thickness in inches

W = Width in inches

L = Length in feet

a. 1 - 1" x 10" x 10' =

b. 1 - 1" x 4" x 14' =

c. 1 - 2" x 6" x 8' =

d. 1 - 2" x 8" x 10' =

e. 2 - 2" x 4" x 8'

f. 5 - 1" x 8" x 8'=

g. 10 - 4" x 6" x 10' =

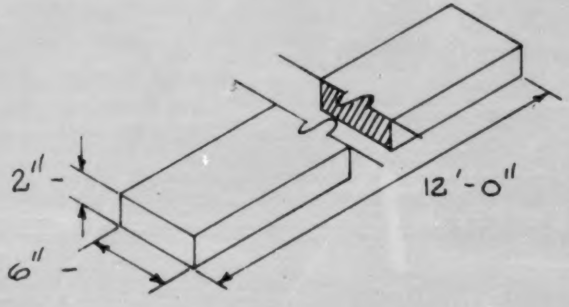
h. 1 - 2" x 4" x 18' =

i. 100 - 2" x 12" x 24' =

j. 30 - 1" x 2" x 6' =

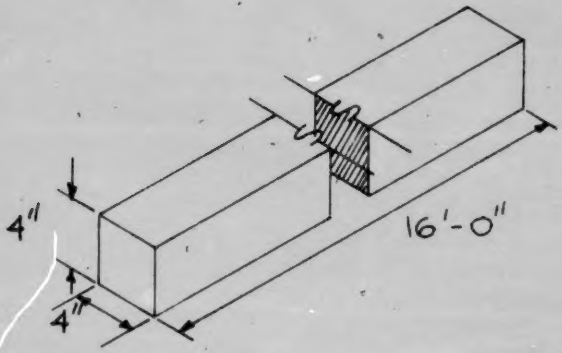
2. Compute the total board feet for each of the pieces of lumber.

a. ____________________

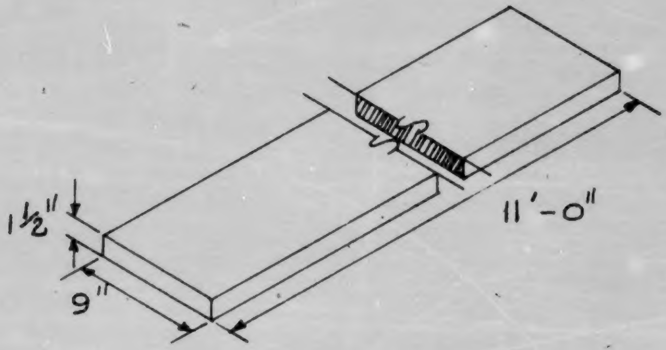


ASSIGNMENT SHEET #1

b. ______________________



c. ______________________



LUMBER
UNIT I

ASSIGNMENT SHEET #2--COMPUTE THE COST OF MATERIALS

Compute the cost for each of the lumber orders listed below.

1. 10 - 2" x 4" x 12', utility, fir, price $16.00 per 100 (C) board feet.

   Answer: $ ______________

2. 30 - 1" x 6" x 16', #2, yellow pine, price $200.00 per 1000 (M) board feet.

   Answer: $ ______________

3. 40 - 1" x 12" x 14', #2, white pine, price $.30 per board foot.

   Answer: $ ______________

4. 100 feet, casing, white pine, price $16.00 per C.

   Answer: $ ______________

LUMBER
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. a. 9 board feet
   b. 5 board feet
   c. 8 board feet
   d. 14 board feet
   e. 11 board feet
   f. 27 board feet
   g. 200 board feet
   h. 12 board feet
   i. 4,800 board feet
   j. 30 board feet
2. a. 1 board foot
   b. 22 board feet
   c. 13 board feet

Assignment Sheet #2

1. $12.80
2. $48.00
3. $168.00
4. $16.00

LUMBER
UNIT I

TEST

NAME ______________________________ SCORE ______________

1. Match the types of softwood lumber to their grades. Place the appropriate numbers in the blanks provided.

______a. 2" - 5" thick, 2" and wider

______b. Select; construction; standard; utility; economy

______c. Board 1" - 1 1/2" thick, 2" and wider

______d. No. 1 common; No. 2 common; No. 3 common; No. 4 common

______e. B and better; C select; D select

______f. No. 1; No. 2; No. 3

______g. 5" and thicker, 5" and wider

1. Common grades
2. Southern pine
3. Yard lumber
4. West coast douglas fir
5. Framing grade dimensions
6. Framing grade timbers
7. Finish grades

2. Match letters designating veneers used in fir plywood to the correct descriptions on the left. Place the appropriate numbers in the blanks provided.

______a. Relatively smooth; permits circular repair plugs; small tight knots

______b. Intended for natural finish; select all heartwood free from all open defects; may contain few repairs if well matched

______c. Permits knots and knotholes to 2 1/2" in width and 1/2" larger under certain specified limits; limited splits permitted

______d. Improved C

______e. Smooth, paintable, well jointed; permits neatly made repairs

______f. Minimum veneer permitted in exterior-type; knotholes up to 1"; splits, tight knots, shims, and sanding defects

1. N
2. A
3. B
4. C
5. C (plugged)
6. D

3. List the standard fir plywood grades by face veneer.

a. Interior by face veneer

1) ______________________________

2) ______________________________

3) ____

4) ____

5) ____

6) ____

7) ____

b. Exterior by face veneer

1) ____

2) ____

3) ____

4) ____

5) ____

6) ____

7) ____

8) ____

4. Write a bill-of materials for ordering the following lumber using the proper sequence, abbreviations, and terms. The materials are ten boards, one inch thick, fourteen feet long, ten inches wide, number two common grade, white pine lumber, kiln dried.

5. List the major methods used in sawing lumber.

   a. ______________________________

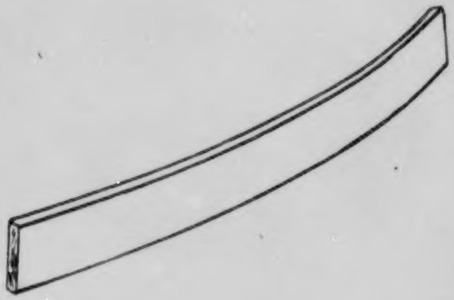
   b. ______________________________

6. List the methods of drying lumber.

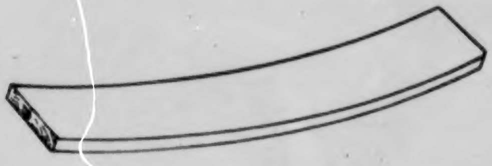
   a. ______________________________

   b. ______________________________

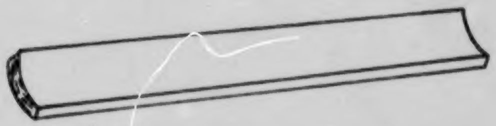
7. Identify the common lumber defects by writing the correct names in the blanks provided.



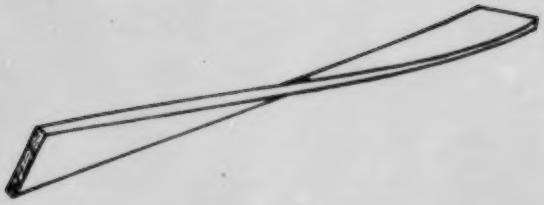
   a. ______________________________



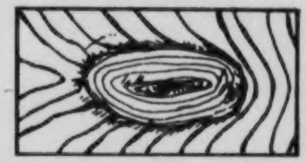
   b. ______________________________



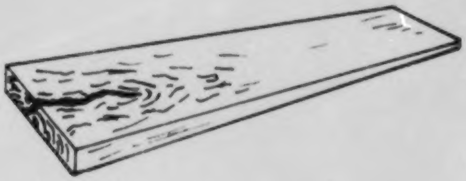
   c. ______________________________



d. ____



e. ____



f. ____

8. Compute the number of board feet and cost in the following bill of materials: 40 - 2" x 6" x 16', utility, yellow pine, KD, S4S at $270.00 per M.

   a. Board feet--

   b. Cost--

LUMBER
UNIT I

ANSWERS TO TEST

1. a. 5
   b. 4
   c. 3
   d. 1
   e. 7
   f. 2
   g. 6
2. a. 3
   b. 1
   c. 6
   d. 5
   e. 2
   f. 4
3. a. Interior by face veneer
   1) AA
   2) AB
   3) AC
   4) BB
   5) BC
   6) CC
   7) CD

   b. Exterior by face veneer
   1) AA
   2) AB
   3) AD
   4) BB
   5) BD
   6) CD
   7) BB plyform
   8) HDO plyform
4. 10 - 1" x 10" x 14', No. 2 common, white pine, KD
5. a. Quarter sawed
   b. Plain sawed or flat sawed
6. a. Air-dried
   b. Kiln-dried
7. a. Crook
   b. Bow
   c. Cup
   d. Twist or wind
   e. Knot
   f. Check
8. a. 640 board feet
   b. $172.80

MEASURING
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the basic measuring tools used by the carpenter. The student should be able to read a rule in feet, inches, and fractions of inches down to one-sixteenth of an inch, measure objects, and draw objects to specified dimensions. This knowledge will be evidenced by completion of assignment sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with measuring to the correct definitions.
2. Identify basic measuring tools used by the carpenter.
3. Read a rule to the nearest one-sixteenth of an inch.
4. Measure objects.
5. Draw objects to specified dimensions.

MEASURING
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information and assignment sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information and assignment sheets.

  F. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Measuring Tools

    2. TM 2--Graduations on a Rule

    3. TM 3--Reading the Eighths Rule

    4. TM 4--Reading the Sixteenths Rule

  D. Assignment sheets

    1. Assignment Sheet #1--Read a Rule

    2. Assignment Sheet #2--Measure Objects

    3. Assignment Sheet #3--Draw Lines and Objects

  E. Answers to assignment sheets

  F. Test

  G. Answers to test

III. Unit references:

A. McDonnell, Leo P. *Hand Woodworking Tools.* Albany, New York: Delmar Publishers, 1962.

B. Division of Stanley Works, Educational Department. *Stanley Tool Guide.* New Britain, Connecticut: Stanley Tools, 1972.

MEASURING
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Measuring--Setting of limits or bounds according to a predetermined standard
- B. Inch--Smallest whole unit of lineal measure commonly used in carpentry
- C. Foot--Unit of measure consisting of twelve equal parts or inches
- D. Fraction--One or more equal parts of a whole

  Examples: 1/2, 1/4, 3/8, 5/16
- E. Rule--Instrument used in measuring that is graduated in whole units and fractions of units
- F. Dimension--Number of full units and fractions of units between two points
- G. Modular--Standardized units or dimensions for flexibility and variety in use

II. Basic measuring tools used by the carpenter (Transparency 1)

- A. Bench rule
- B. Steel framing square
- C. Steel tapes
- D. Folding rule
- E. Combination square
- F. Mason's modular rule

III. Reading a rule (Transparencies 2, 3, and 4; Assignment Sheet #1)

- A. All rules read similarly

  (NOTE: Some rules are graduated with more divisions per inch than others, and layout tapes are marked sixteen inches on center.)

INFORMATION SHEET

B. Procedures for reading

1. Determine number of graduations per inch

   a. Locate small figure at 0 end of rule which designates divisions per inch

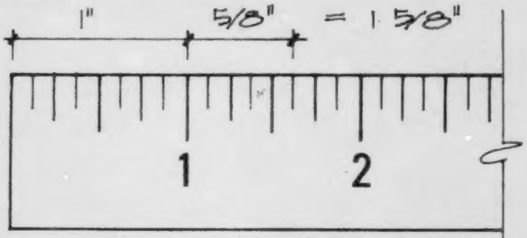
   b. Count the divisions in one inch

   c. Gain skill in determining the divisions through practice

2. Determine inches and fractions of an inch

   a. Count the graduations in that fraction of an inch beyond the last full inch

   Example:



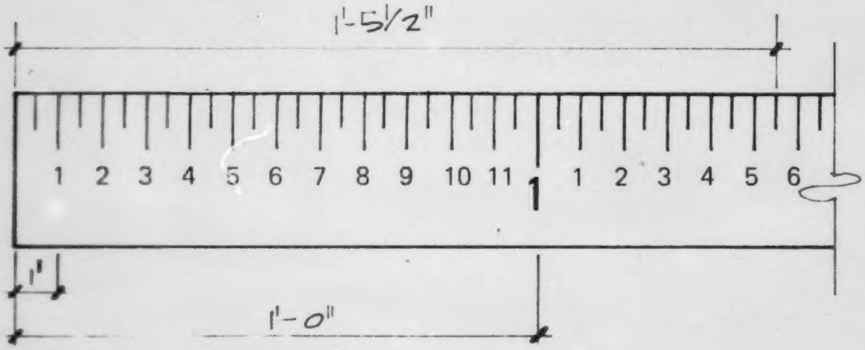
   b. Add the fraction to the last full inch

   (NOTE: In the above example, the total amount equals one and five-eighths inch.)

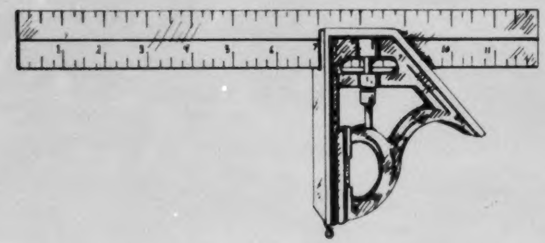
3. Reduce the fraction if possible

4. Determine the feet and add the inches and fraction of an inch to obtain a correct measurement

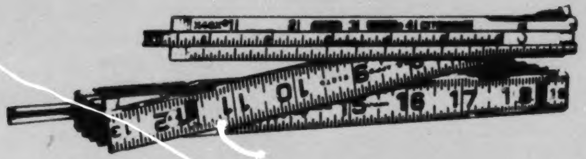
   Example:



Measuring Tools

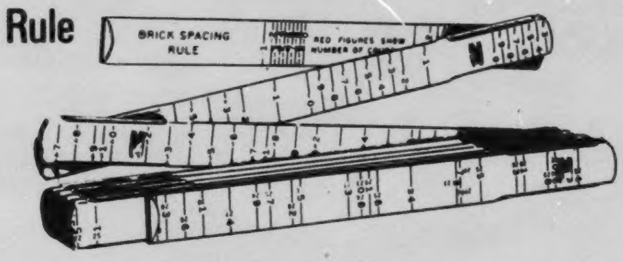


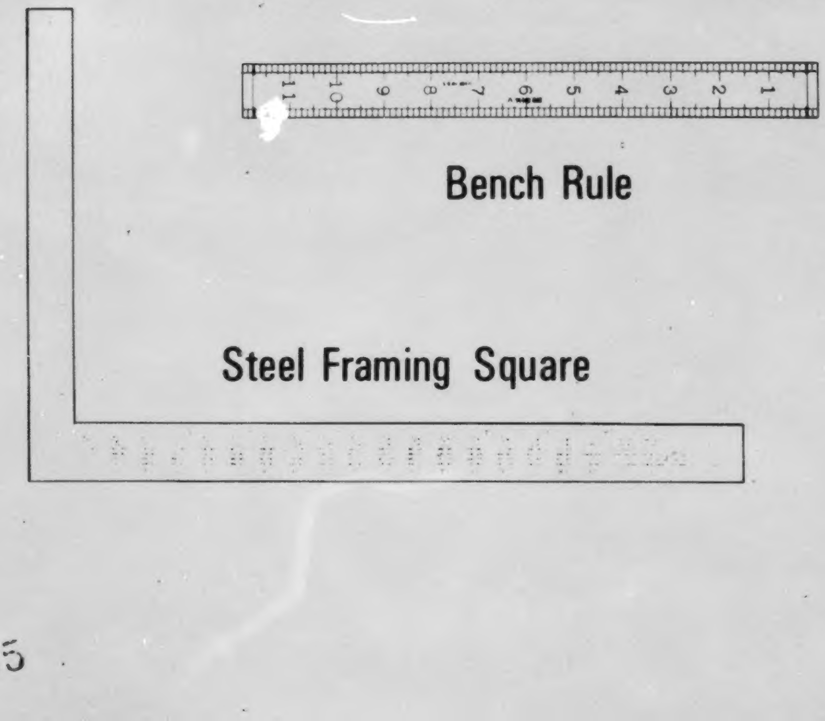
Combination Square



Folding Rule

Mason's Modular Rule

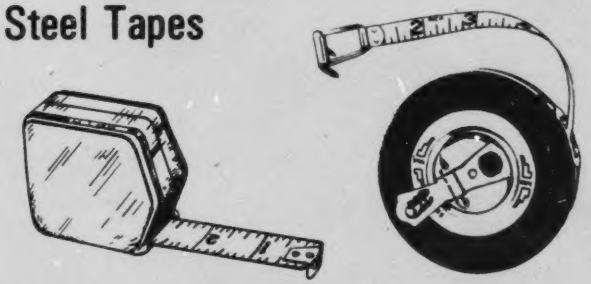

BRICK SPACING RULE
RED FIGURES SHOW NUMBER OF COURSES


1
2
3
4
5
6
7
8
9
10
11

Bench Rule

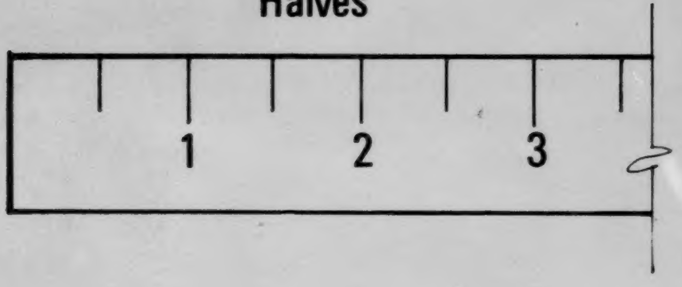
Steel Framing Square

Steel Tapes

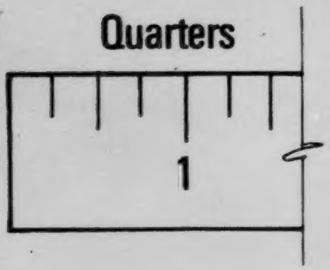


Graduations on a Rule

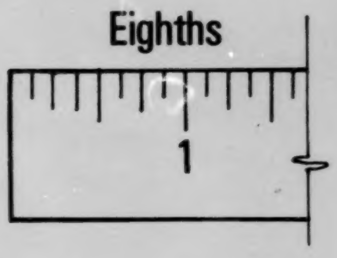
Halves



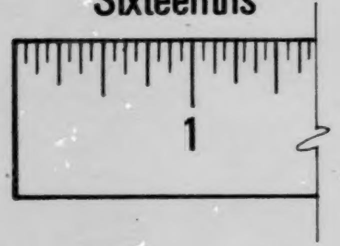
Quarters



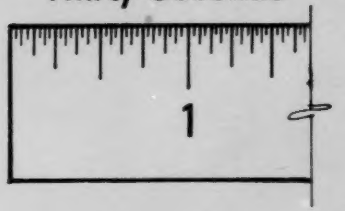
Eighths

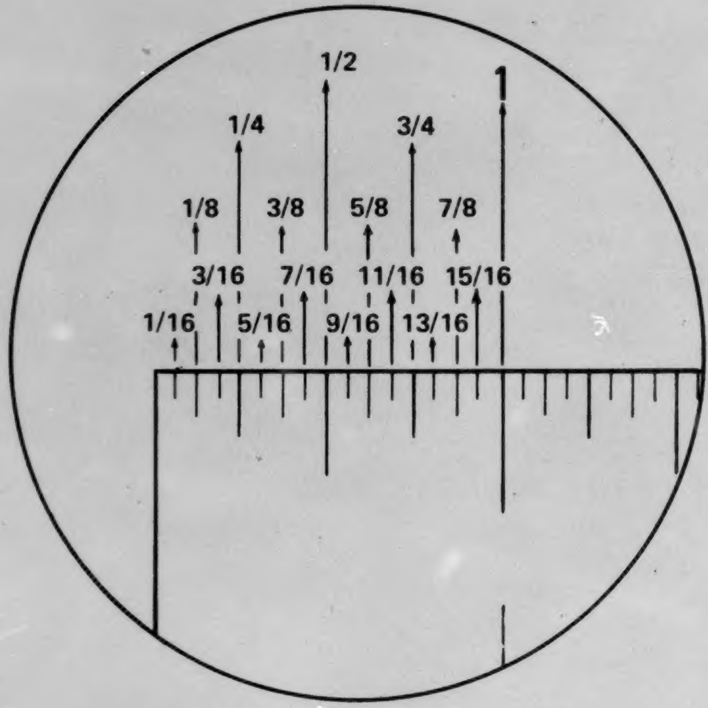


Sixteenths



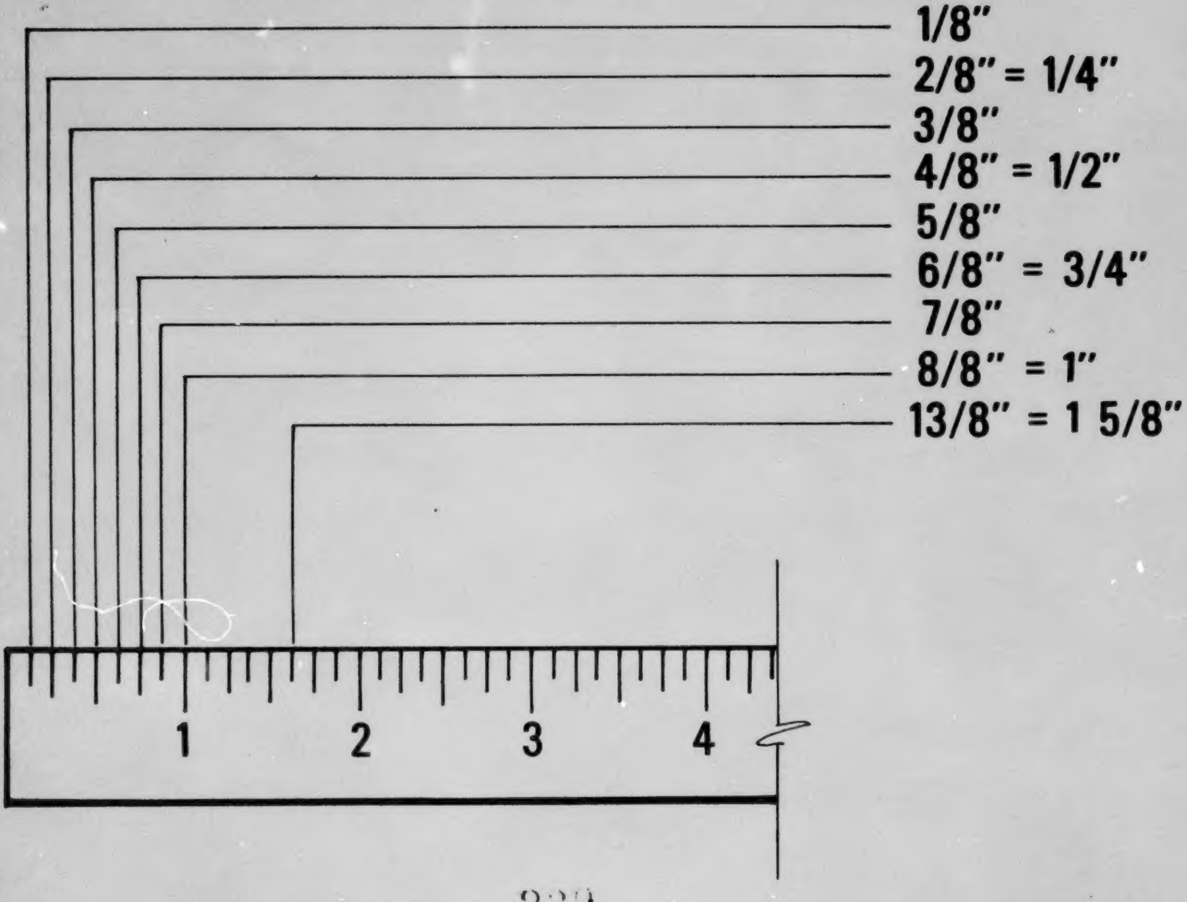
Thirty-Seconds



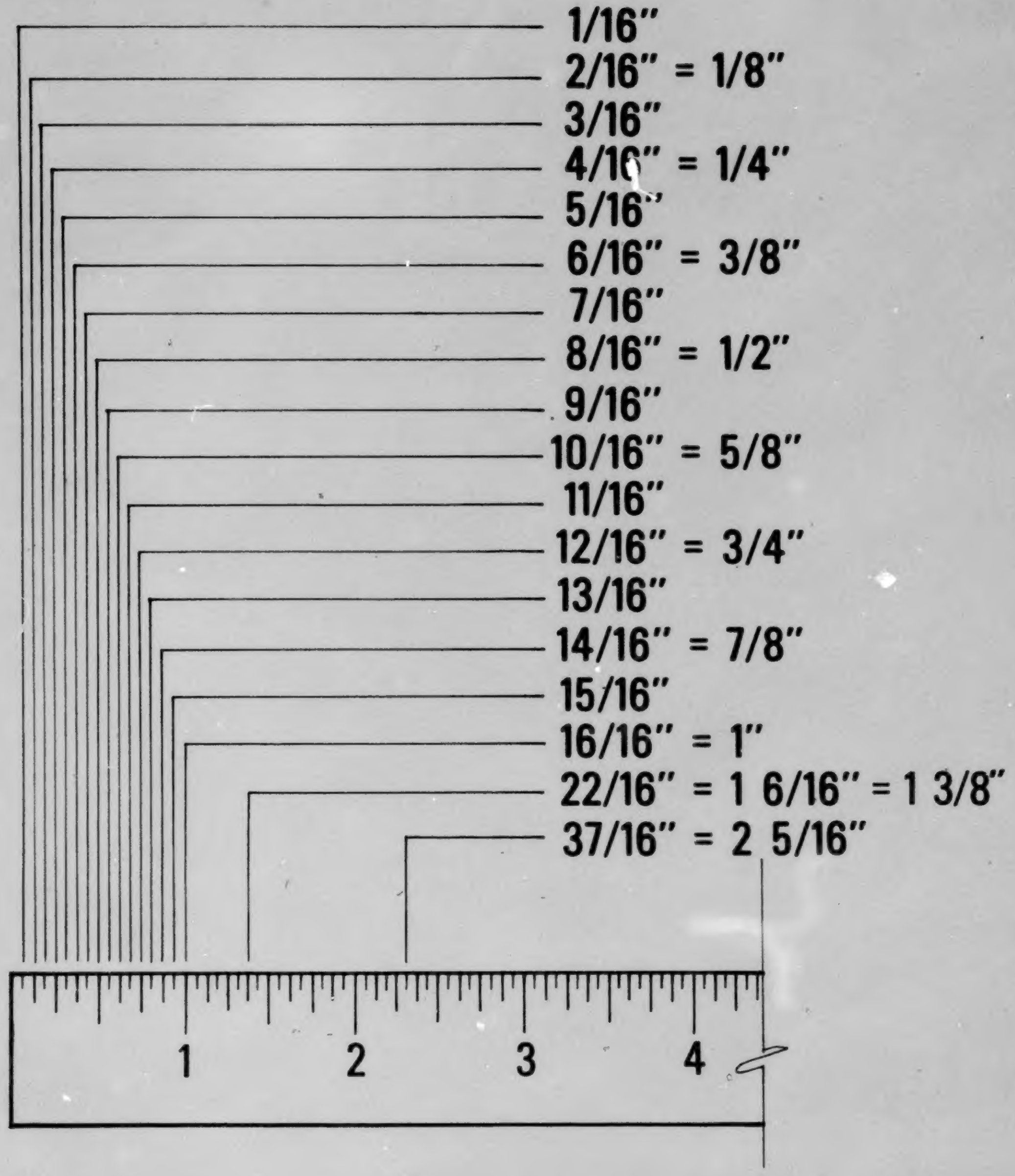

1/2
1
1/4
3/4
1/8
3/8
5/8
7/8
3/16
7/16
11/16
15/16
1/16
5/16
9/16
13/16

Graduations Applied to a Rule

Reading the Eighths Rule


1/8"
2/8" = 1/4"
3/8"
4/8" = 1/2"
5/8"
6/8" = 3/4"
7/8"
8/8" = 1"
13/8" = 1 5/8"
1
2
3
4

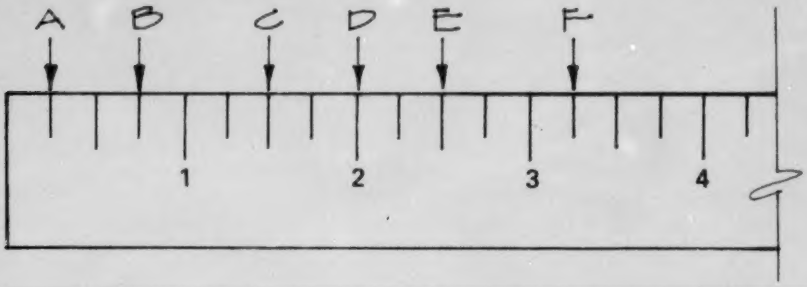
Reading the Sixteenths Rule


1/16"
2/16" = 1/8"
3/16"
4/16" = 1/4"
5/16"
6/16" = 3/8"
7/16"
8/16" = 1/2"
9/16"
10/16" = 5/8"
11/16"
12/16" = 3/4"
13/16"
14/16" = 7/8"
15/16"
16/16" = 1"
22/16" = 1 6/16" = 1 3/8"
37/16" = 2 5/16"
1
2
3
4

MEASURING
UNIT II

ASSIGNMENT SHEET #1--READ A RULE

1. Use the drawing below and read the rule to the nearest 1/4". Reduce when possible.



a.

b.

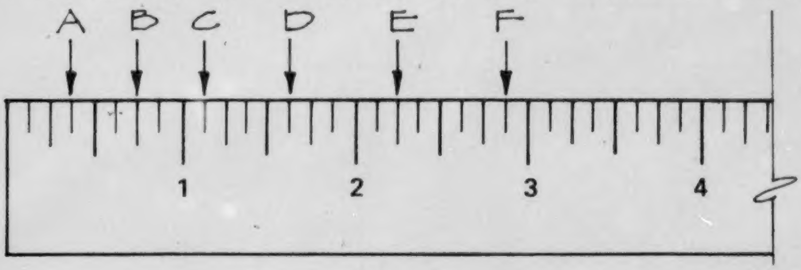
c.

d.

e.

f.

2. Use the drawing below and read the rule to the nearest 1/8". Reduce when possible.



a.

b.

c.

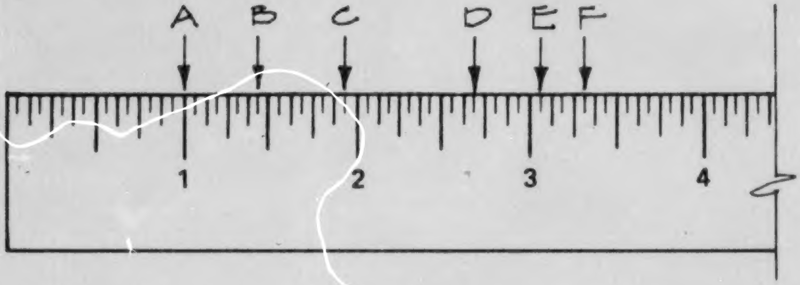
d.

e.

f.

ASSIGNMENT SHEET #1

3. Use the drawing below and read the rule to the nearest 1/16". Reduce when possible.



a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

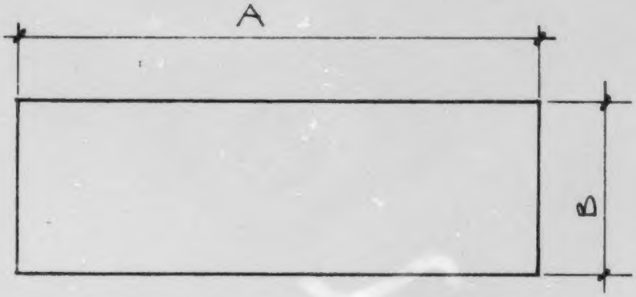
f. ______________________________

MEASURING
UNIT II

ASSIGNMENT SHEET #2--MEASURE OBJECTS

Using a rule with 1/16" graduations, measure the following objects.

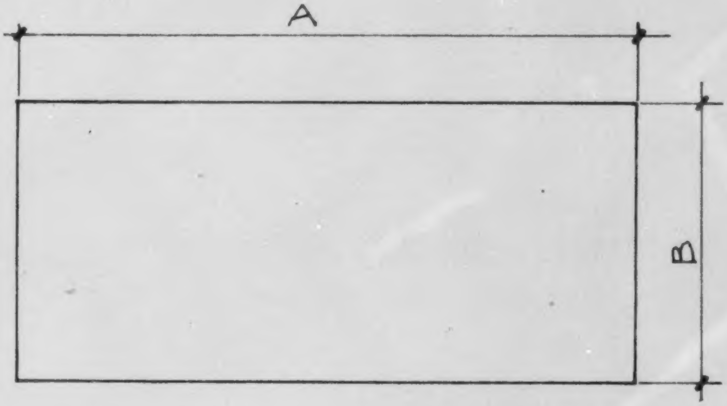
1.



a. Length ______________________________

b. Height ______________________________

2.

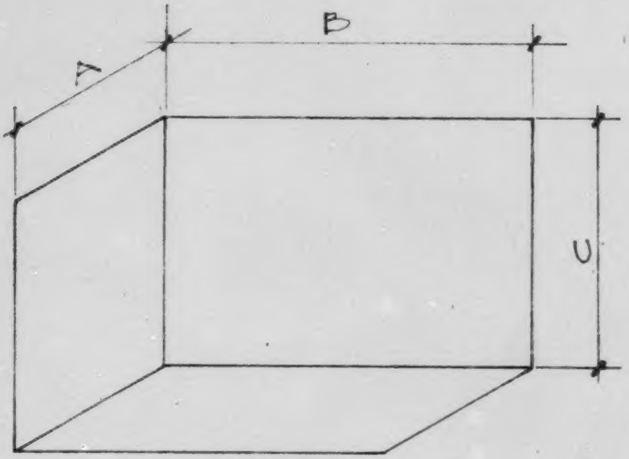


a. Length ______________________________

b. Height ______________________________

ASSIGNMENT SHEET #2

3.

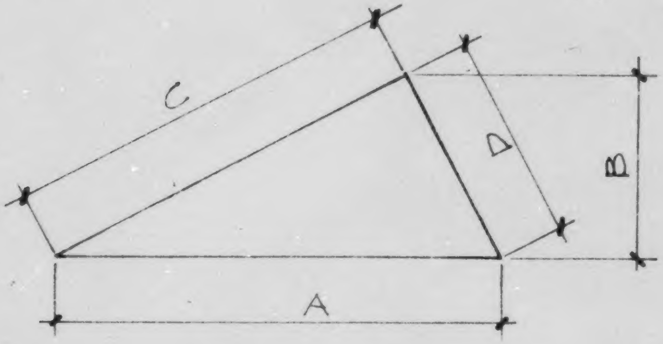


a. Width ______

b. Length ______

c. Height ______

4.



a. Base ______

b. Height ______

c. Slope #1 ______

d. Slope #2 ______

MEASURING
UNIT II

ASSIGNMENT SHEET #3--DRAW LINES AND OBJECTS

Using a rule with 1/16" graduations, draw the following lines and objects to the given dimensions.

1. Draw straight lines to the following lengths.
   a. 3 3/4"
   b. 2 1/16"
   c. 3 5/8"
   d. 1 1/4"
   e. 2 5/8"
2. Draw a rectangle with a height of one and seven-eighths inches and a length of two and three-sixteenths inches.

ASSIGNMENT SHEET #3

3. Draw a triangle with a base length of two and one-half inches, a height of one and one-quarter inches, and one slope of two and one-eighth inches.

MEASURING
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. a. 1/4"
b. 3/4"
c. 1 1/2"
d. 2"
e. 2 1/2"
f. 3 1/4"

2. a. 3/8"
b. 3/4"
c. 1 1/8"
d. 1 5/8"
e. 2 1/4"
f. 2 7/8"

3. a. 1"
b. 1 7/16"
c. 1 15/16"
d 2 11/16"
e. 3 1/16"
f. 3 5/16"

Assignment Sheet #2

1. a. 3"
b. 1"

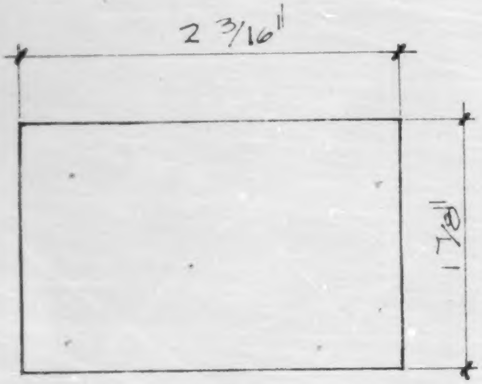
2. a. 3 9/16"
b. 1 5/8"

3. a. 1"
   b. 2 1/8"
   c. 1 7/16"
4. a. 2 9/16"
   b. 1 1/16"
   c. 2 1/4"
   d. 1 3/16"

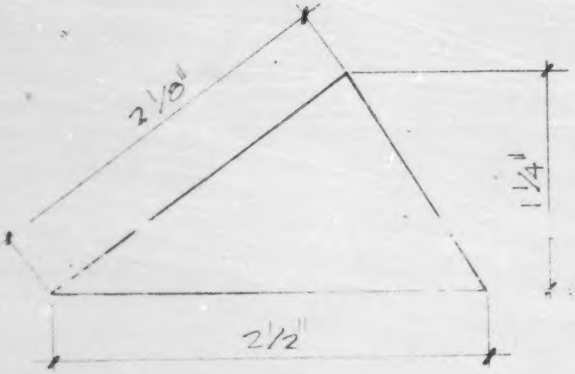
Assignment Sheet #3

1. a. 3 3/4"
   b. 2 1/16"
   c. 3 5/8"
   d. 1 1/4"
   e. 2 5/8"

2.



3.



MEASURING
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Setting of limits or bounds according to a predetermined standard

______b. Smallest whole unit of lineal measure commonly used in carpentry

______c. Unit of measure consisting of twelve equal parts or inches

______d. One or more equal parts of a whole

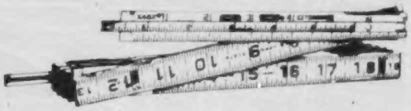
______e. Instrument used in measuring that is graduated in whole units and fractions of units

______f. Number of full units and fractions of units between two points

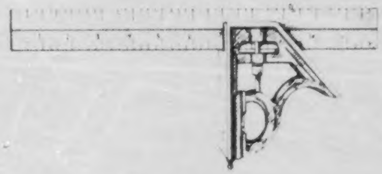
______g. Standardized units or dimensions for flexibility and variety in use

1. Measuring
2. Rule
3. Modular
4. Dimension
5. Inch
6. Fraction
7. Foot

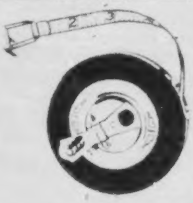
2. Identify the following basic measuring tools used by the carpenter by placing the appropriate names in the blanks provided.



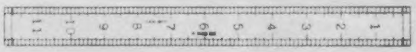
a. ______________________________



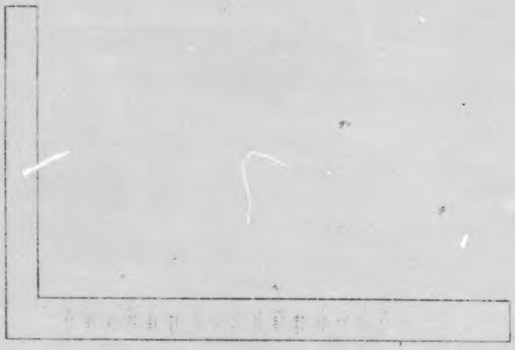
b. ______________________________

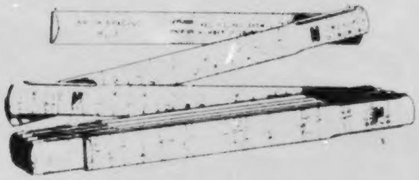


c. ______________________________



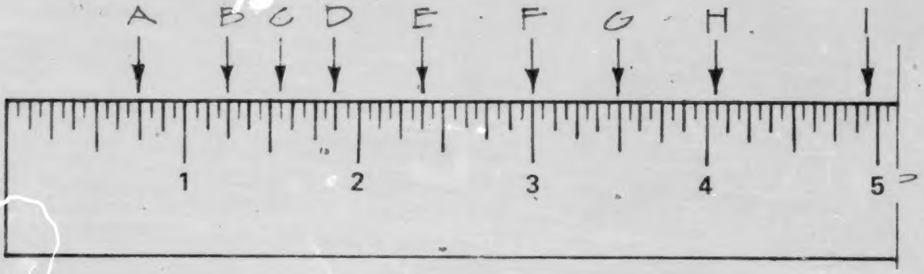
d. ______________________________





e. ____________________ f. ____________________

3. Read the rule below to the nearest one-sixteenth of an inch. Reduce when possible.



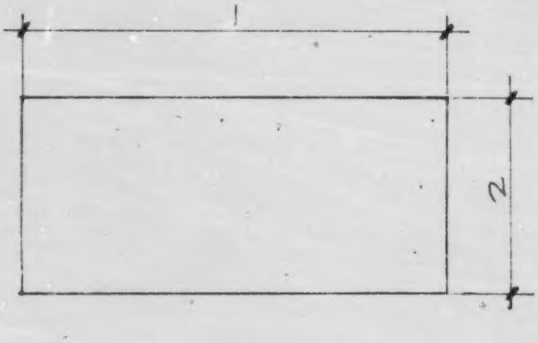
a. ____________ d. ____________ g. ____________

b. ____________ e. ____________ h. ____________

c. ____________ f. ____________ i. ____________

4. Measure the following objects to the nearest one-sixteenth of an inch.

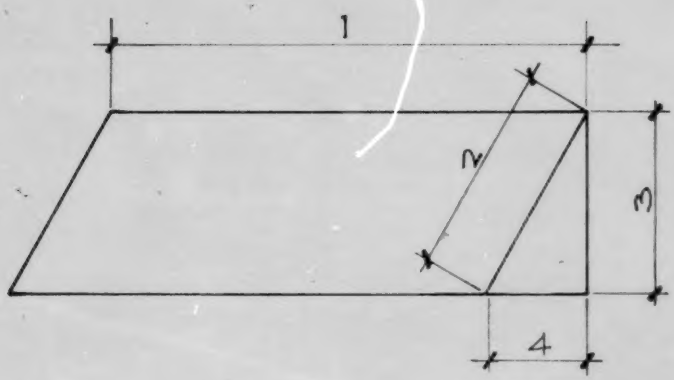
a.



1) ____________________

2) ____________________

b.



1) ____________________

2) ____________________

3) ____________________

4) ____________________

5. Draw objects to the specified dimensions given below.

   a. Draw a 1 7/8" square.

b. Draw a rectangle 1 5/8" x 2 1/4".

c. Draw a triangle with a base line of 2", a height of 7/8", and one slope of 15/16".

MEASURING
UNIT II

ANSWERS TO TEST

1. a. 1

b. 5

c. 7

d. 6

e. 2

f. 4

g. 3

2. a. Folding rule

b. Combination square

c. Steel tape

d. Bench rule

e. Steel framing square

f. Mason's modular rule

3. a. 3/4"

b. 1 1/4"

c. 1 9/16"

d. 1 7/8"

e. 2 3/8"

f. 3"

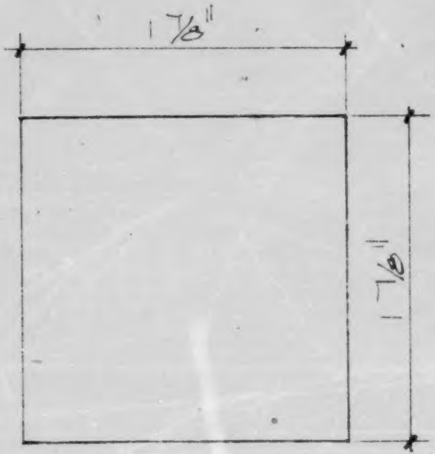
g. 3 1/2"

h. 4 1/16"

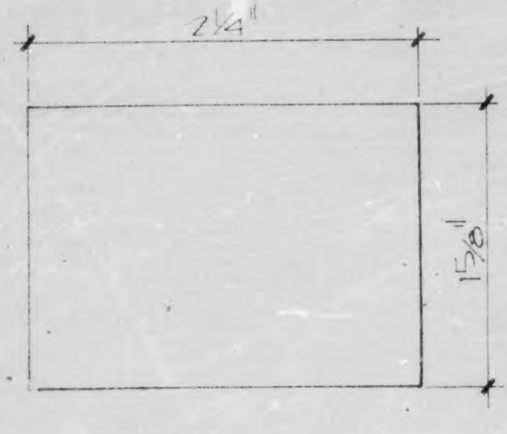
i. 4 15/16"

4. a. 1) 2 7/16"
   2) 1 1/8"
   b. 1) 2 3/4"
   2) 1 3/16"
   3) 1 1/16"
   4) 9/16"

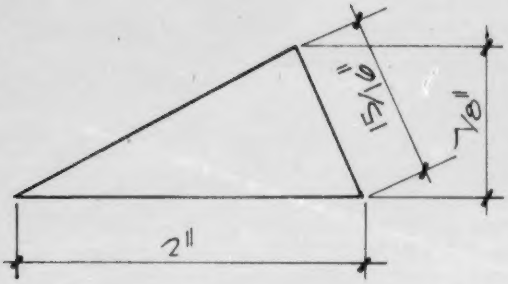
5. a.



b.



c.



HARDWARE AND FASTENERS
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to define *fastener* and *anchor/insert* and identify the lengths and penny weights of nails. The student should be able to name the coatings and materials used for nails and the types of connections made with screws. The student should be able to identify the various kinds of screws, bolts, and finish hardware; name kinds of glue; and define *epoxy resins* and *contact cement.* This knowledge will be evidenced by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Define *fastener* as used in building construction.
2. Define *anchor/insert* as used in building construction.
3. Identify the lengths and penny weights of nails used most often in construction.
4. Name coatings for nails.
5. Name materials used to manufacture nails.
6. Identify types of screw heads.
7. Identify types of screws.
8. Name types of connections made with screws.
9. Identify types of bolts.
10. Identify finish hardware.
11. Name kinds of glue.
12. Define *epoxy resins*.
13. Define *contact cement*.

HARDWARE AND FASTENERS
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide student with objective sheet.

   B. Provide student with information sheet.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   (NOTE: This unit does not include all hardware and suppliers since it is only a general introduction to the subject of hardware and fasteners.)

   F. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Anchors and Inserts

      2. TM 2--Anchors and Inserts (Continued)

      3. TM 3--Anchors and Inserts (Continued)

      4. TM 4--Nails

      5. TM 5--Types of Screws

      6. TM 6--Types of Bolts

      7. TM 7--Finish Hardware

      8. TM 8--Finish Hardware (Continued)

      9. TM 9--Finish Hardware (Continued)

   D. Test

   E. Answers to test

III. Unit references:

A. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry.* 4th ed. vol. 1. Chicago: American Technical Society, 1967.

B. Feirer, John L. *Cabinetmaking and Millwork.* Peoria, Illinois: Charles A. Bennett Company, Inc., 1967.

C. Feirer, John L. *Woodworking for Industry.* Peoria, Illinois: Charles A. Bennett Company, Inc., 1971.

D. Hackett, Donald F., and Spielman, Patrick E. *Modern Wood Technology.* Milwaukee, Wisconsin: The Bruce Publishing Company, 1968.

E. Wagner, Willis H. *Modern Carpentry.* Homewood, Illinois: Goodheart-Wilcox Company, Inc., 1969.

F. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

G. *Burke Concrete Accessories, Inc. Catalog #600.* Burlingame, California: Burke Concrete Accessories.

HARDWARE AND FASTENERS
UNIT III

INFORMATION SHEET

I. Fastener as used in building construction--Any device, such as a nail, screw, or bolt, used to hold adjacent members together

II. Anchor/insert as used in building construction--Any device used to attach something and/or to give stability to one part of the structure by securing it to a more stable part of the structure (Transparencies 1, 2, and 3)

III. Lengths of nails used most often in construction (Transparency 4)

Penny Size	Length in Inches For Common, Box, and Finish Nails
2d	1
3d	1 1/4
4d	1 1/2
5d	1 3/4
*6d	2
7d	2 1/4
*8d	2 1/2
9d	2 3/4
10d	3
12d	3 1/4
*16d	3 1/2
*20d	4
30d	4 1/2
40d	5
50d	5 1/2
60d	6

*Sizes most often used in construction

IV. Coatings for nails

- A. Cement
- B. Galvanized

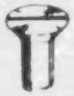
V. Materials used to manufacture nails

- A. Steel
- B. Aluminum

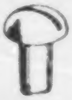
INFORMATION SHEET

VI. Types of screw heads

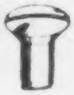
A. Flat head



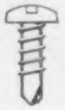
B. Round head



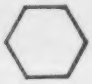
C. Oval head



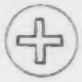
D. Pan head



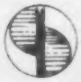
E. Hex head



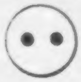
F. Phillips



G. One-way



H. Safety screw



VII. Types of screws (Transparency 5)

A. Wood

B. Metal

C. Combination

VIII. Types of connections made with screws (Transparency 1)

A. Wood to wood

B. Metal to wood

C. Metal to metal (light metal)

D. Wood to concrete or masonry

E. Metal to concrete or masonry

INFORMATION SHEET

IX. Types of bolts (Transparency 6)

- A. Spring wing toggle
- B. Lag
- C. Stove
- D. Carriage
- E. Machine
- F. Anchor

X. Finish hardware (Transparencies 7, 8, and 9)

- A. Door lock
- B. Butt hinge
- C. Cabinet hardw[illegible]
- D. Door closer
- E. Sash lock
- F. Closet rod
- G. Window hardware
- H. Panic device
- I. Shelf bracket
- J. Push plate and door pull
- K. Sliding door hardware
- L. Kick plate
- M. Door stop and wall bumper
- N. Threshold

XI. Kinds of glue

- A. Waterproof

  (NOTE: This is recommended for the most severe exposure, such as exterior and marine use.)

- B. Water-resistant

  (NOTE: This is recommended for exterior exposure in which there will be some protection from the elements.)

INFORMATION SHEET

C. Low water-resistant

(NOTE: This is recommended for interior use only.)

XII. Epoxy resins--Two-part adhesives

(NOTE: When mixed together, a chemical action takes place which provides an ideal adhesive material for joining almost any material.)

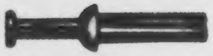
(CAUTION: Use extreme care when mixing. Do not get material on skin.)

XIII. Contact cement--Neoprene-based resin; rubber-type adhesive

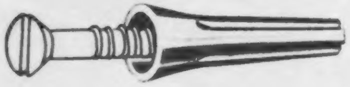
(NOTE: The adhesive is applied to both surfaces and allowed to dry, and then the surfaces are brought together. The bond is immediate. Its main use is in gluing plastic laminates to backing material.)

(CAUTION: Use extreme care when mixing. Do not get material on skin.)

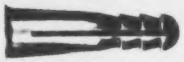
Anchors and Inserts



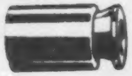
Drive Anchors



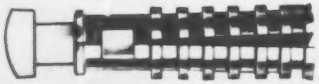
Wood Screw Lead Anchors



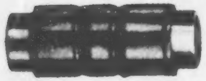
Plastic Screw Anchors



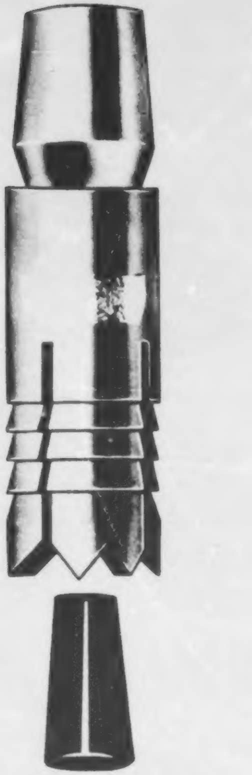
Machine Screw Anchors



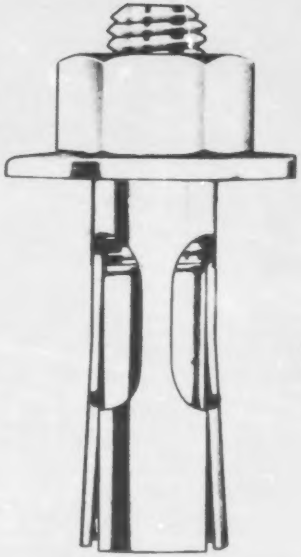
Lag Screw Shields



Double Expansion Bolt Shields



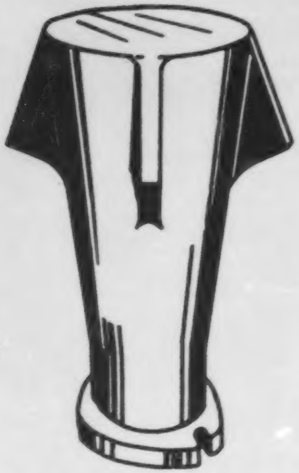
Self-Drilling Anchor

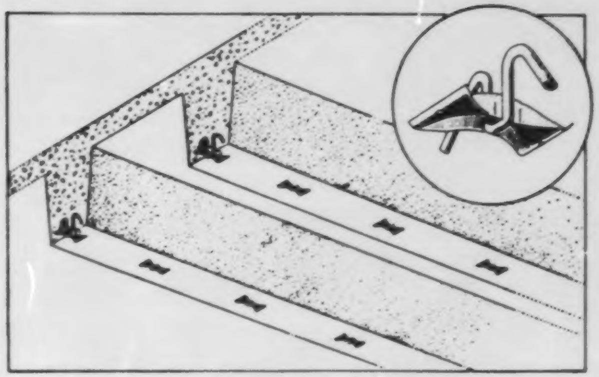


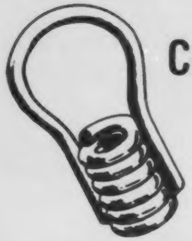
Bolt and Anchor Unit

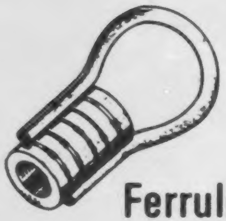
Anchors and Inserts

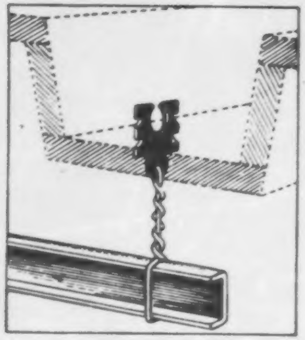
(Continued)

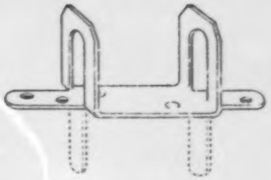

Threaded Insert

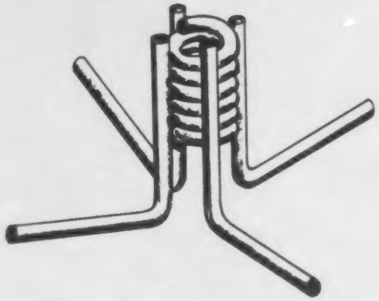

Hanger Inserts


Coil Loop Insert


Ferrule Loop Insert

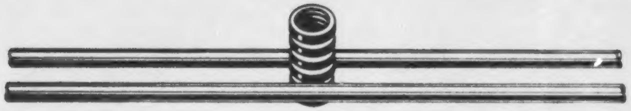

Drive-In Insert


Acoustical Clip

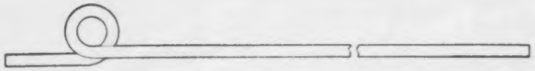

Special Thin Slab Insert

Anchors and Inserts

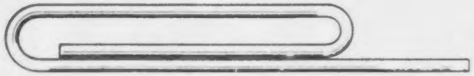
(Continued)



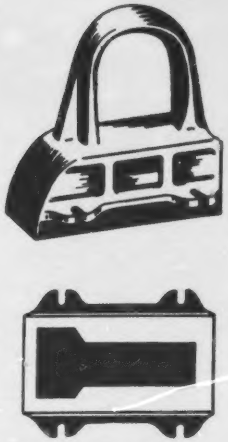
Thin Slab Insert



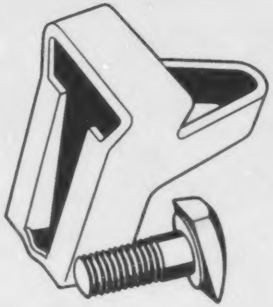
Pigtail Wire Ceiling Hanger



Loop Dowel Anchor (LDA)

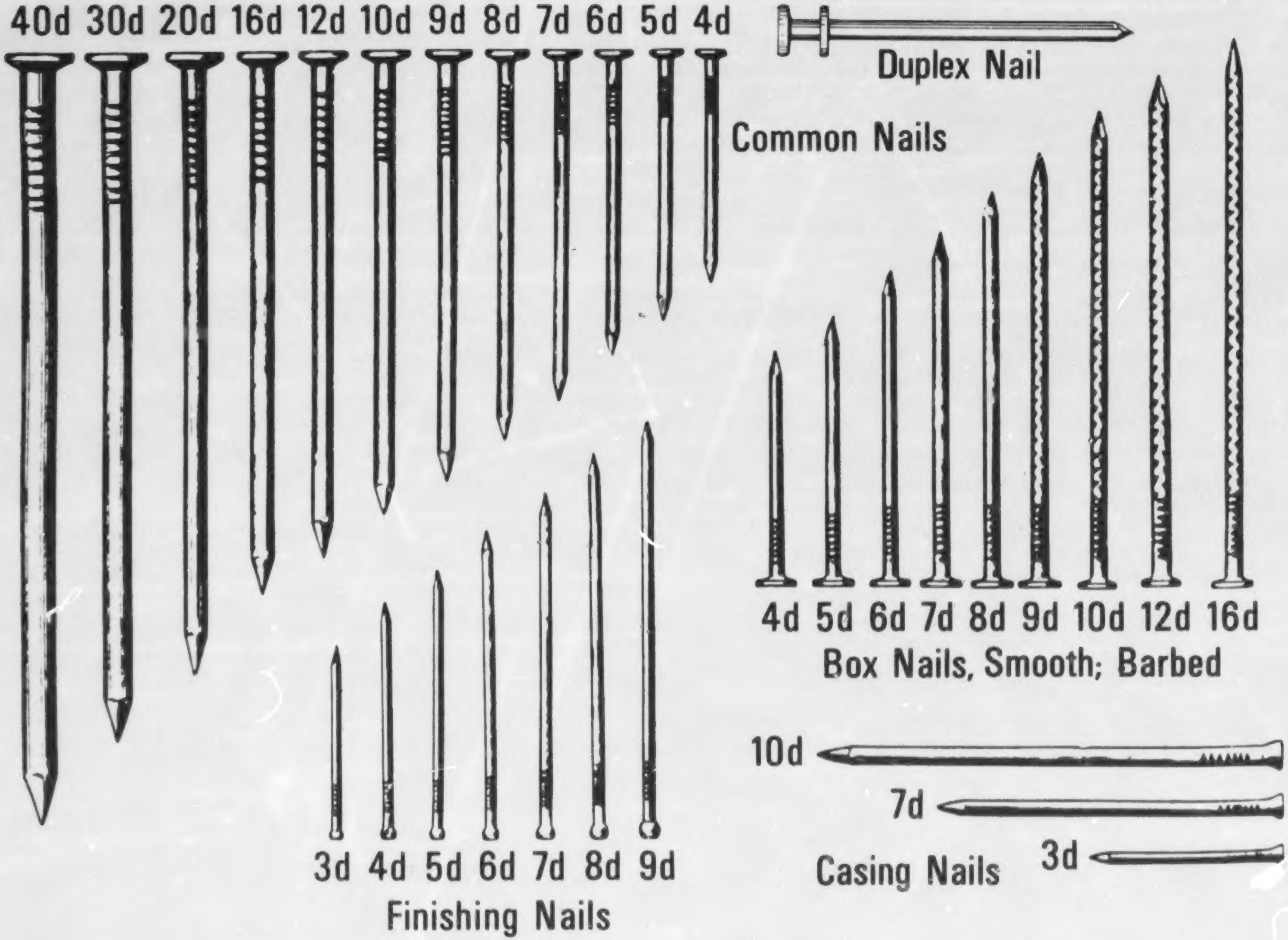


Malleable
Adjustable Inserts

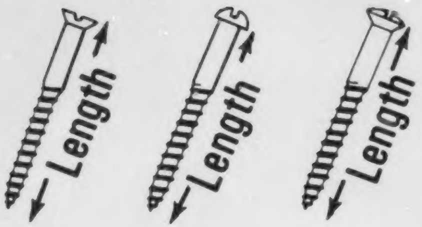


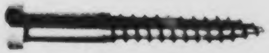
Shelf Angle Inserts

Nails


40d 30d 20d 16d 12d 10d 9d 8d 7d 6d 5d 4d
Common Nails
Duplex Nail
4d 5d 6d 7d 8d 9d 10d 12d 16d
Box Nails, Smooth; Barbed
10d
7d
3d
Casing Nails
3d 4d 5d 6d 7d 8d 9d
Finishing Nails

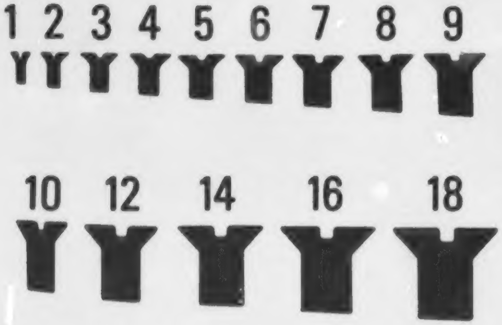
Types of Screws


Length
Length
Length

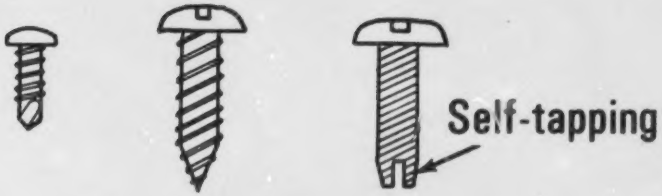


Lag Screw

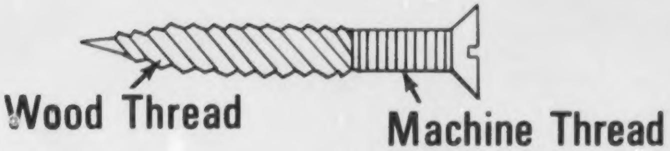
Determine Screw Shank Sizes
by Comparison Below


1
2
3
4
5
6
7
8
9
10
12
14
16
18

Wood Screws

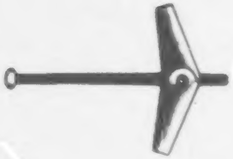

Self-tapping

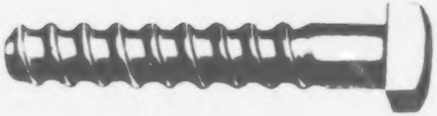
Metal Screws

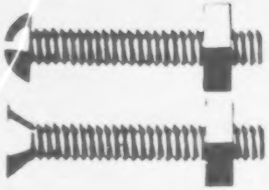

Wood Thread
Machine Thread

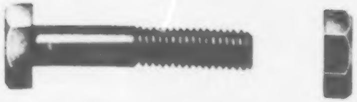
Combination Screw

Types of Bolts


Spring Wing Toggle Bolt


Lag Bolt

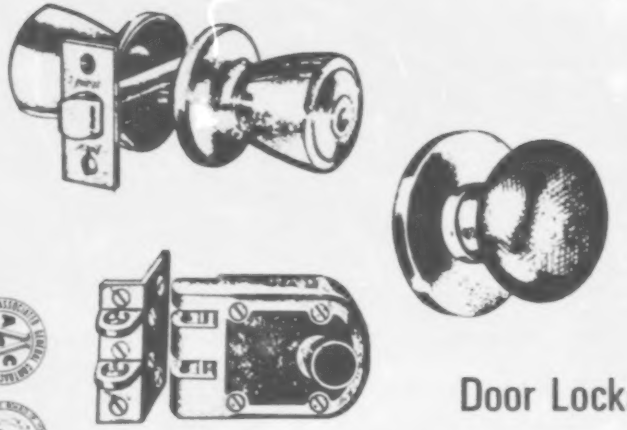

Stove Bolts

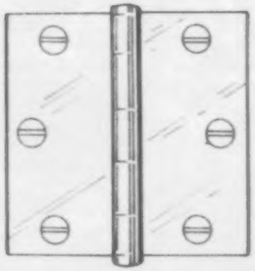

Machine Bolts

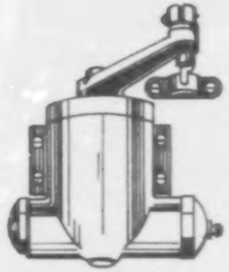
Carriage Bolt

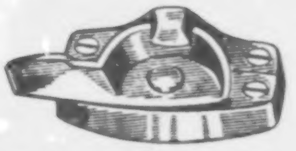
Anchor Bolt

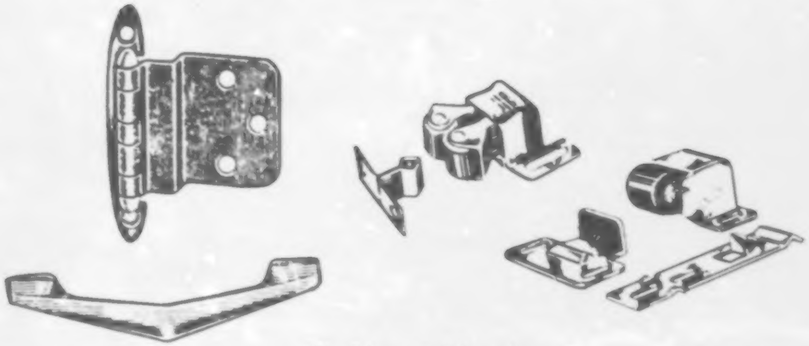
Finish Hardware


Door Locks


Butt Hinge


Door Closer

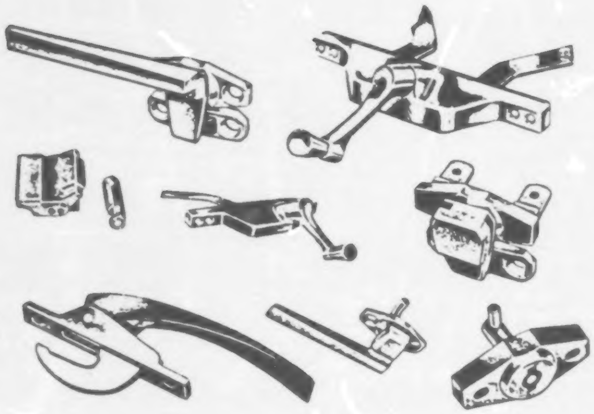

Sash Lock


Cabinet Hardware

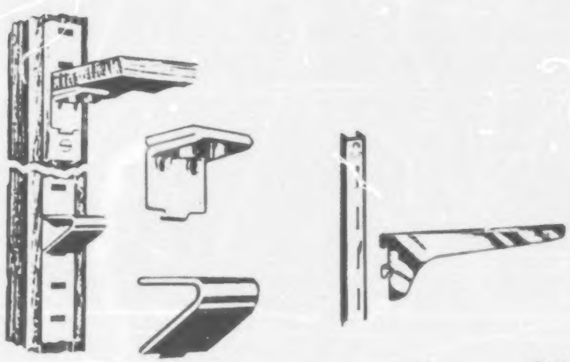
Closet Rod

Finish Hardware

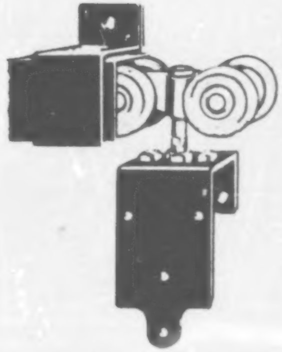
(Continued)



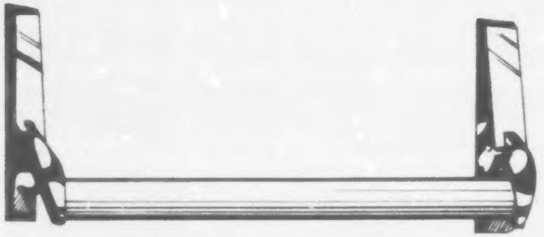
Window Hardware



Shelf Brackets

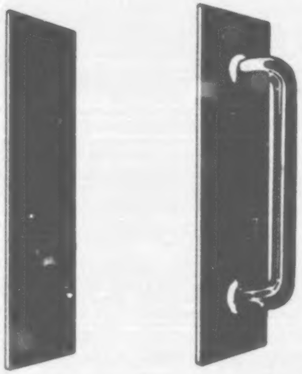


Sliding Door Hardware



Panic Devices

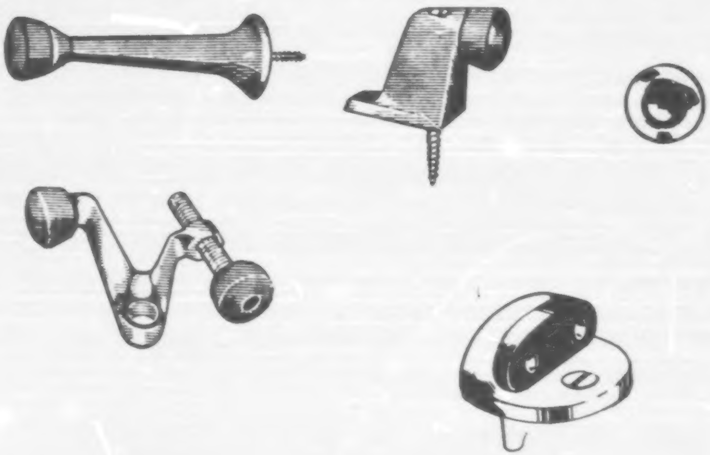
Kick Plate



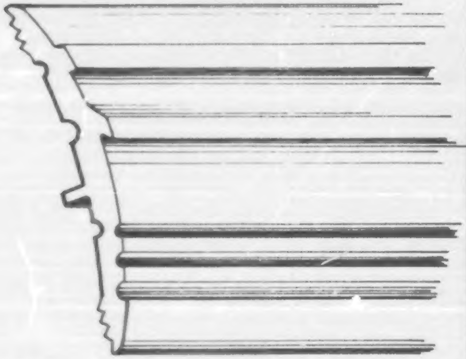
Push Plate and Door Pull

Finish Hardware
(Continued)

Door Stops and Wall Bumpers



Threshold



HARDWARE AND FASTENERS
UNIT III

TEST

NAME ______________________ SCORE ____________

1. Define *fastener* as used in building construction.

____

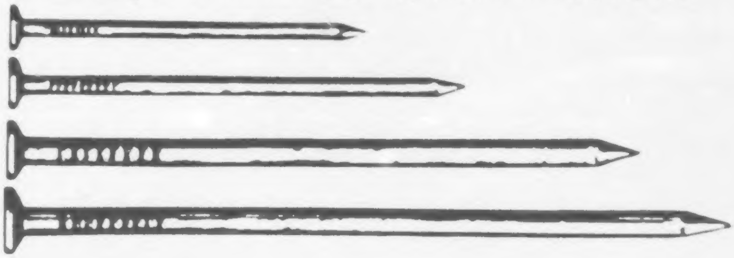
____

2. Define *anchor/insert* as used in building construction.

____

____

3. Identify the lengths and penny weights of the nails used most often in construction.



a. ____________

b. ____________

c. ____________

d. ____________

4. Name the coatings for nails.

a. ____

b. ____

5. Name two materials used to manufacture nails.

a. ____

b. ____

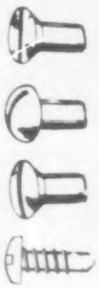
6. Identify the types of screw heads below.

a. ____________

b. ____________

c. ____________

d. ____________

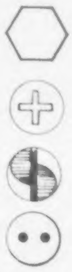


e. ____________

f. ____________

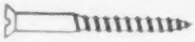
g. ____________

h. ____________

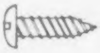


7. Identify the types of screws below.

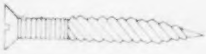
a. ______________________



b. ______________________



c. ______________________



8. Name the types of connections made with screws.

a. ____

b. ____

c. ____

d. ____

e. ____

9. Identify the types of bolts below by writing the correct numbers in the blanks provided.

______a. Lag

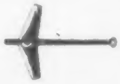
______b. Spring wing toggle

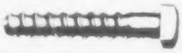
______c. Anchor

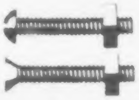
______d. Machine

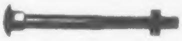
______e. Stove

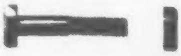
______f. Carriage

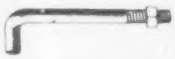
1. 

2. 

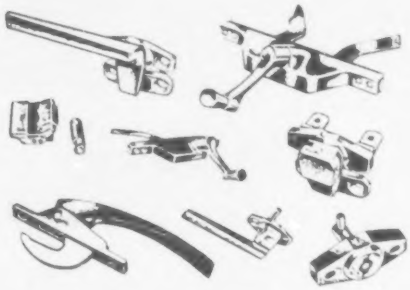
3. 

4. 

5. 

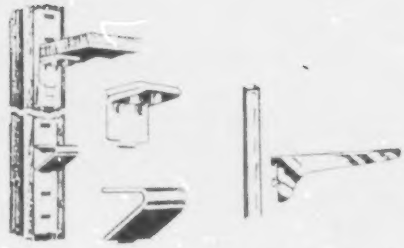
6. 

10. Identify the finish hardware below and on the following pages by writing the correct names in the blanks provided.

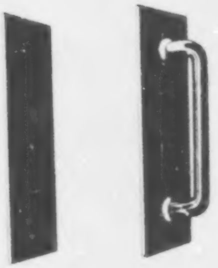


a. ______________________

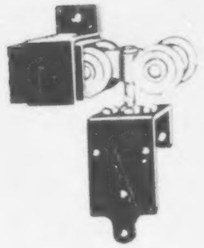
b. ______________________



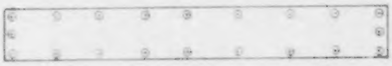
c. ______________________



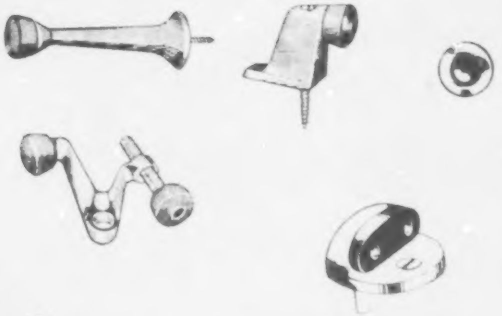
d. ______________________



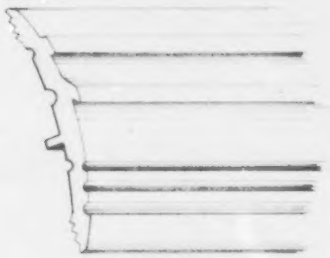
e. ______________________



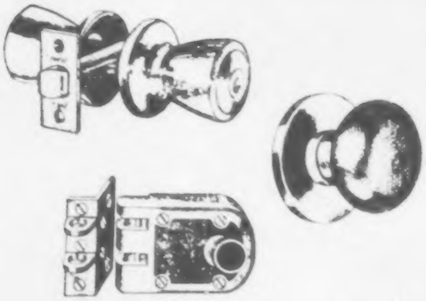
f. ______________________



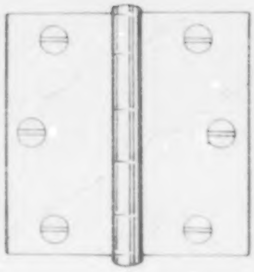
g. ______________________



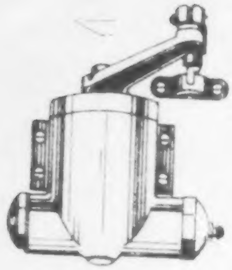
h. ______________________



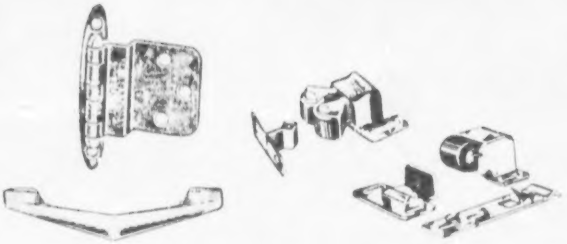
i. ______________________



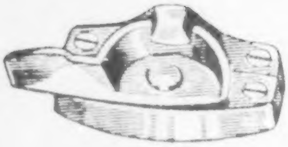
j. ______________________



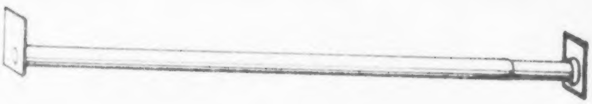
k.



l.



m.



n.

11. Name kinds of glue.

a.

b.

c.

12. Define *epoxy resins.*

13. Define *contact cement*.

HARDWARE AND FASTENERS
UNIT III

ANSWERS TO TEST

1. Any device, such as a nail, screw, or bolt, used to hold adjacent members together
2. Any device used to attach something and/or to give stability to one part of the structure by securing it to a more stable part of the structure
3. a. 6d 2"
   b. 8d 2 1/2"
   c. 16d 3 1/2"
   d. 20d 4"
4. a. Cement
   b. Galvanized
5. a. Steel
   b. Aluminum
6. a. Flat head
   b. Round head
   c. Oval head
   d. Pan head
   e. Hex head
   f. Phillips
   g. One-way
   h. Safety
7. a. Wood
   b. Metal
   c. Combination
8. a. Wood to wood
   b. Metal to wood

c. Metal to metal (light metal)

d. Wood to concrete or masonry

e. Metal to concrete or masonry

9. a. 2

b. 1

c. 6

d. 5

e. 3

f. 4

10. a. Window hardware

b. Panic device

c. Shelf brackets

d. Push plate and door pull

e. Sliding door hardware

f. Kick plate

g. Door stops and wall bumpers

h. Threshold

i. Door locks

j. Butt hinge

k. Door closer

l. Cabinet hardware

m. Sash lock

n. Closet rod

11. a. Waterproof

b. Water-resistant

c. Low water-resistant

12. Two-part adhesives

13. Neoprene-based resin; rubber-type adhesive

SCAFFOLDING
UNIT IV

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify types of scaffolds and parts of a prefabricated rolling scaffold. The student should be able to identify a swinging scaffold and select from a list safety tips for scaffolding. The student should be able to set up a scaffold and build a double pole scaffold. This knowledge will be evidenced by completion of job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with scaffolding to the correct definitions.
2. Identify the types of scaffolds.
3. Identify the parts of a prefabricated rolling scaffold.
4. Identify a swinging scaffold rigged for a job.
5. Select from a list safety tips for scaffolding.
6. Demonstrate the ability to:
    a. Set up section of scaffold with safety rails.
    b. Build a double pole scaffold.

SCAFF[illegible]DING
UNIT [illegible]V

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide student with objective sheet.

  B. Provide student with information and job sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate the procedures for the accomplishment of the job sheets.

  G. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Types of Scaffolds

    2. TM 2--Types of Scaffolds (Continued)

    3. TM 3--Types of Scaffolds (Continued)

    4. TM 4--Types of Scaffolds (Continued)

    5. TM 5--Types of Scaffolds (Continued)

    6. TM 6--Parts of a Prefabricated Rolling Scaffold

  D. Job sheets

    1. Job Sheet #1--Set Up a Section of Scaffold with Safety Rails

    2. Job Sheet #2--Build a Double Pole Scaffold

  E. Test

  F. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

B. Smith, Ronald C. *Principles and Practices of Light Construction*. Englewood Cliffs: Prentice-Hall Inc., 1970.

C. Woodin, James C., and Hayes, Louis E. *Home and Building Maintenance*. Bloomington, Illinois: McKnight and McKnight, 1969.

D. *Burke Concrete Construction Accessories: Catalog No. 600*. Burlingame, California: Burke Concrete Accessories, Inc., 1970.

SCAFFOLDING
UNIT IV

INFORMATION SHEET

I. Terms and definitions

   A. Scaffold--Elevated and usually temporary platform for supporting workers, tools, and materials while working on a structure

   B. Swinging scaffold (stage)--Type of scaffold normally hung from a structure; used to work high above the ground

   C. Toe boards--Four-inch guardrails to keep tools and materials from falling off scaffold; attached about 1/4" from floor of scaffold

   D. Casters--Wheels for scaffolds, usually with brakes

   E. Safety rails--Guardrails attached about 42" high and midway between 42" and toe boards

   F. Job-built scaffold--Scaffold that is built and set up right on the job site

   G. Scaffold jacks--Angle-shaped devices manufactured to fasten to the forms; support a platform for workers and materials

      (NOTE: It takes at least two jacks.)

   H. Putlog--Short members on which the flooring of a scaffold is laid

   I. Bearer--Any small member which is used primarily to support another member or structure

II. Types of scaffolds (Transparencies 1-5)

   A. Single-pole job-built wood scaffold

   B. Double-pole job-built wood scaffold

   C. Prefabricated steel scaffold

   D. Prefabricated aluminum ladder scaffold

   E. Swinging scaffold

   F. Adjustable steel rolling scaffold

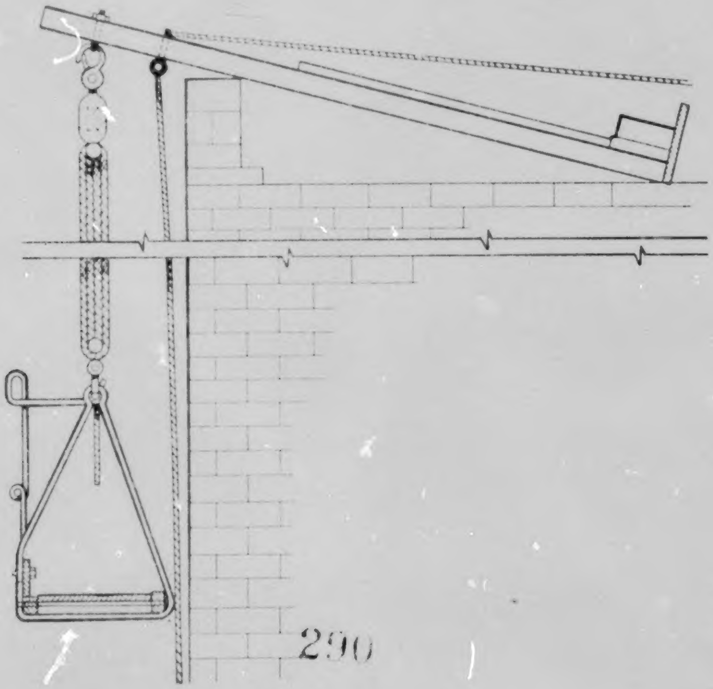
   G. Scaffold jacks with platform

INFORMATION SHEET

III. Parts of a prefabricated rolling scaffold (Transparency 6)

- A. Top guardrail
- B. Mid guardrail
- C. Metal scaffold plank
- D. End frame
- E. Toe board
- F. Cross brace
- G. Caster
- H. Screw jack
- I. Coupling pin
- J. Base plates

IV. Swinging scaffold rigged for a job



INFORMATION SHEET

V. Safety tips for scaffolding

(NOTE: Observe all OSHA safety standards pertaining to scaffolds.)

A. Be sure brakes are set

B. Do not use damaged scaffolds

C. Do not alter or disturb scaffolds while in use

D. Do not try to overreach scaffold

E. Use all three safety rails

F. Do not work on scaffolds during storms, high winds, or when scaffolds are covered with snow and ice

G. Do not throw objects to and/or from scaffold

H. Do not use blocking under legs

I. Be sure all planking or work boards are sound

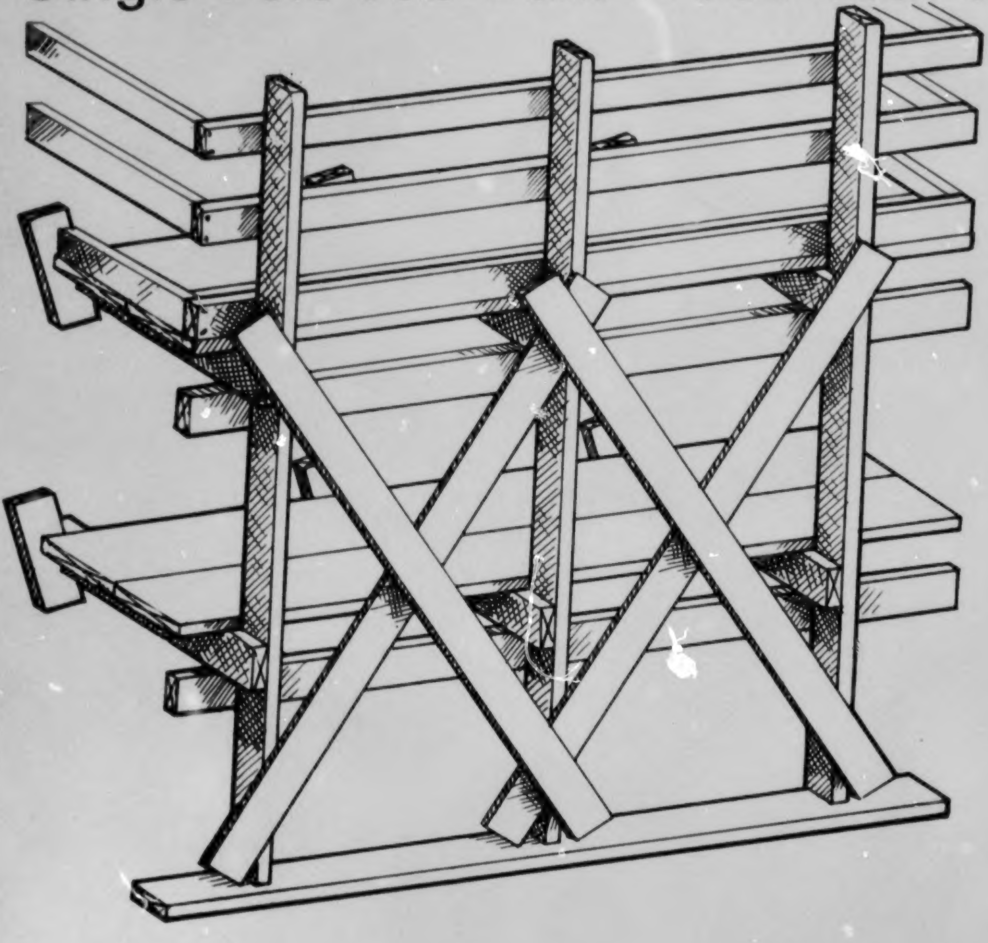
J. Tie off scaffolds about every twenty-five feet when they are built several sections high

K. Use safety belt and/or harness as required

L. Use safety nets as required

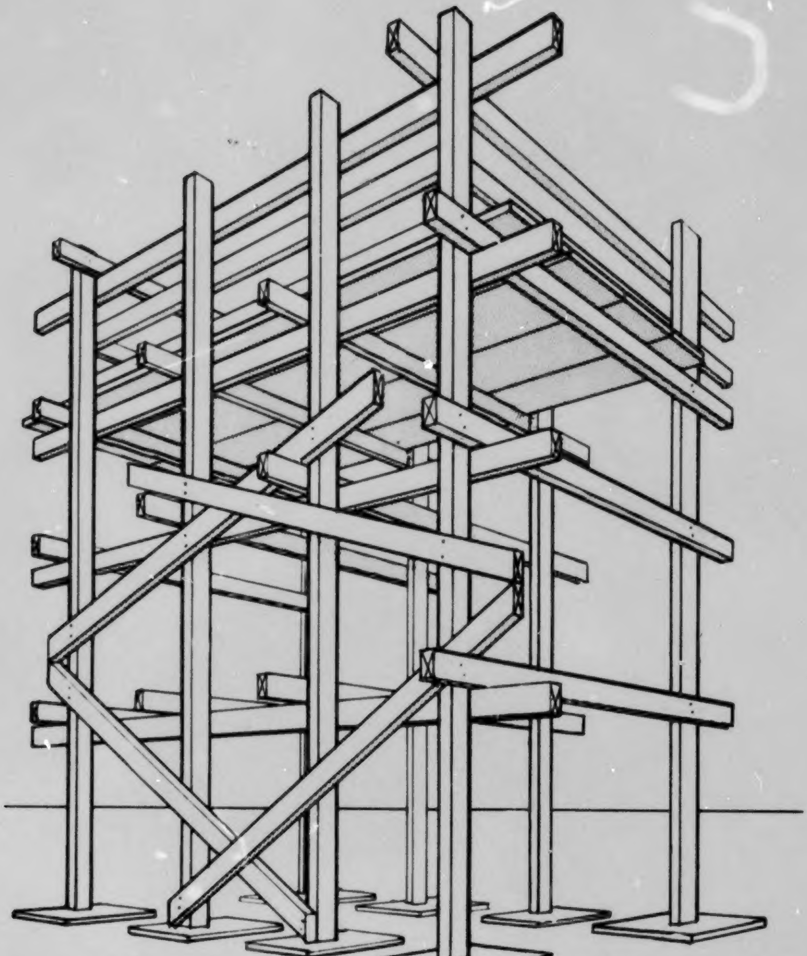
Types of Scaffolds

Single-Pole Job-Built Wood Scaffold



Types of Scaffolds
(Continued)

Double-Pole Job-Built Wood Scaffold



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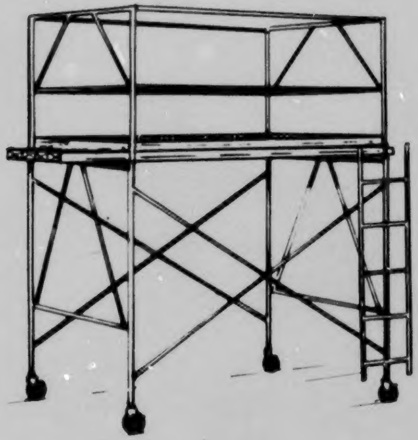
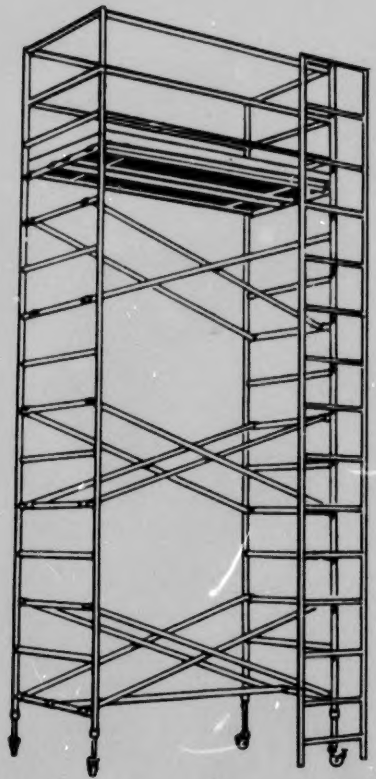
Types of Scaffolds

(Continued)

Prefabricated
Steel Scaffold



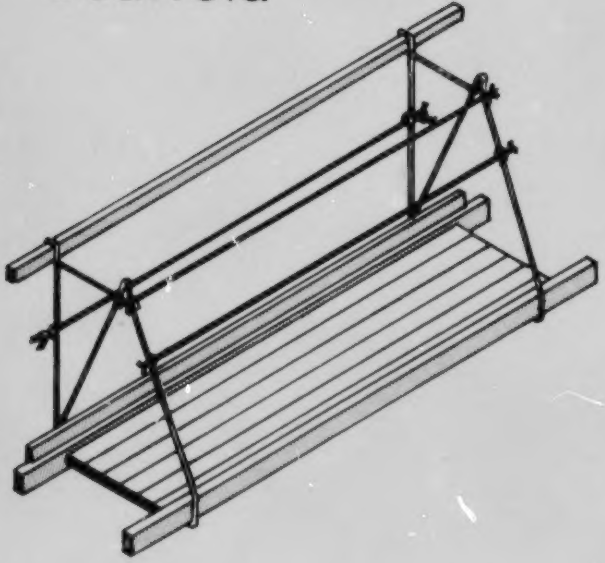


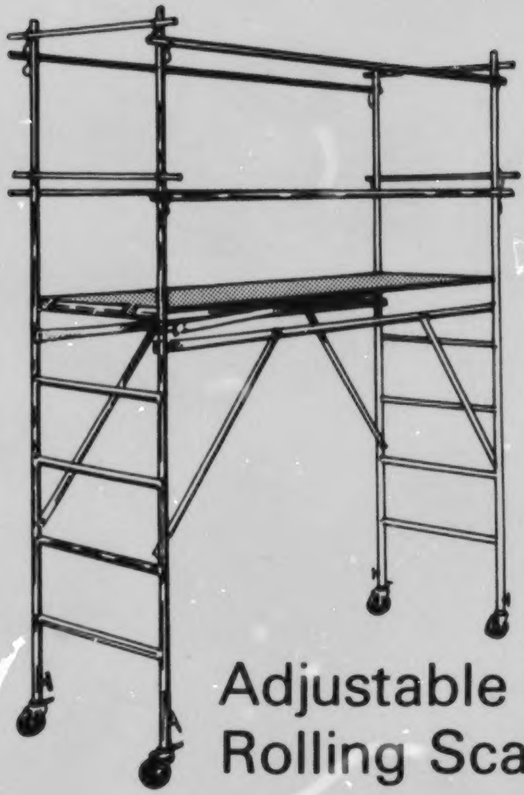
Prefabricated Aluminum Ladder Scaffold

Types of Scaffolds

(Continued)

Swinging Scaffold





Adjustable Steel Rolling Scaffold

TM 4

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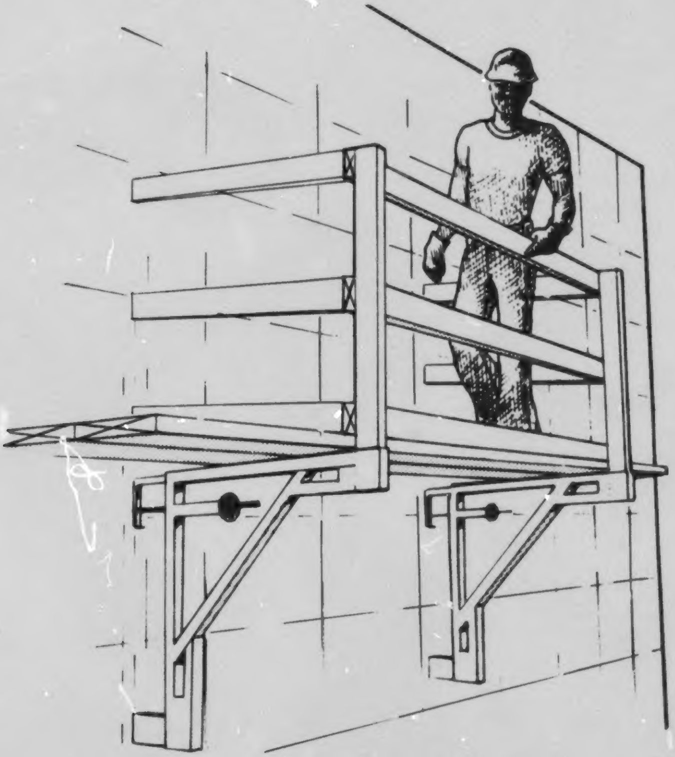
CC - 113-C

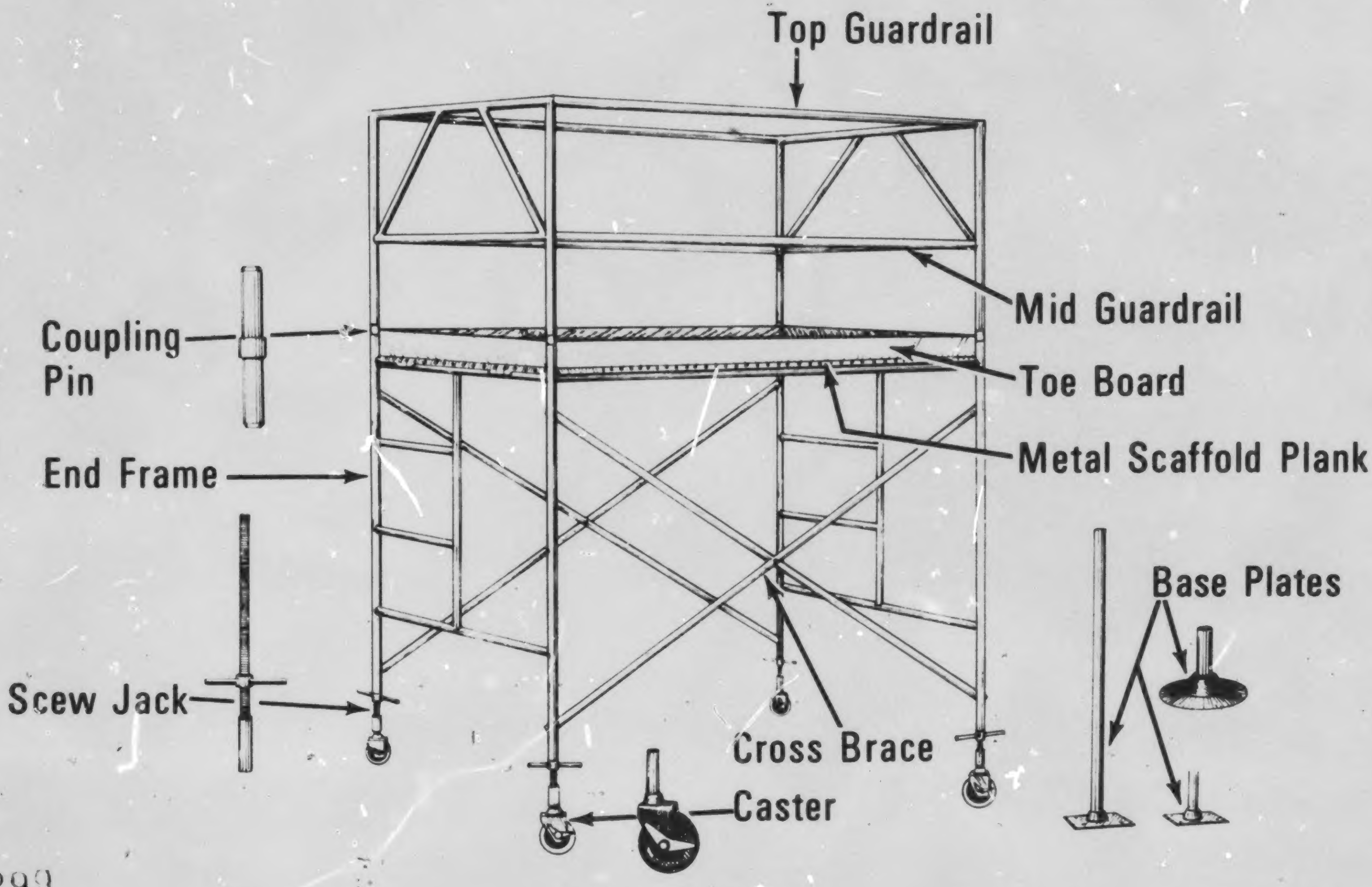
Types of Scaffolds

(Continued)



Scaffold Jacks with Platform

Parts of a Prefabricated Rolling Scaffold


Top Guardrail
Mid Guardrail
Coupling Pin
Toe Board
Metal Scaffold Plank
End Frame
Base Plates
Scew Jack
Cross Brace
Caster

SCAFFOLDING
UNIT IV

JOB SHEET #1--SET UP SECTION OF SCAFFOLD WITH SAFETY RAILS

I. Equipment

A. End frames, four

B. Cross braces, two

C. Scaffold planks, two

(NOTE: Be sure planks have safety cleats.)

D. Guardrails, four

E. Toe boards, four

F. Coupling pins, four

G. Casters, four

H. Ladder section, one

II. Procedure

A. Secure cross braces to one end frame

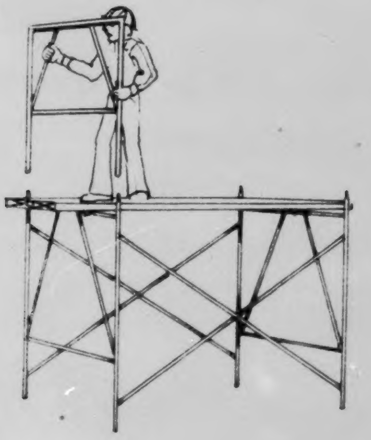
B. Secure cross braces to second end frame

C. Set scaffold planks

D. Set four coupling pins in two end frames

E. Lift and set first end frame while standing on scaffold planks (Figure 1)

FIGURE 1



JOB SHEET #1

F. Set second end frame

G. Secure guardrails

H. Lift one end of scaffold and insert casters; set brakes

I. Lift opposite end of scaffold and insert casters; set brakes

J. Attach one section of ladder (Figure 2)

(NOTE: The completed scaffold is shown in Figure 3.)

FIGURE 2

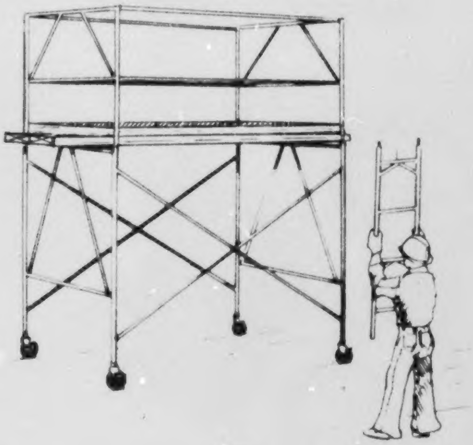
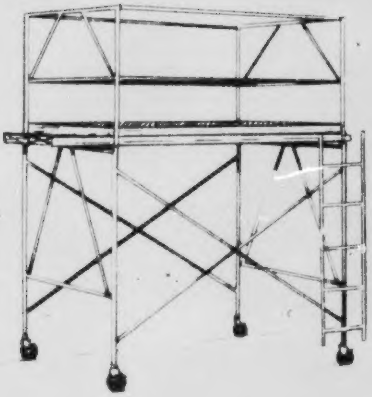


FIGURE 3



SCAFFOLDING
UNIT IV

JOB SHEET #2--BUILD A DOUBLE POLE SCAFFOLD

I. Tools and materials

A. Tools

1. Hammer, 16 oz or larger
2. Handsaw
3. Power saw, hand
4. Tape, 16'
5. Level, 30" minimum
6. Framing square
7. Step ladder

B. Materials

1. Legs, 2 x 4 x 16', 6 each
2. Legs, 2 x 4 x 12', 2 each
3. Stringers and safety rails, 2 x 4 x 10', 8
4. Bearers and/or putlogs, 2 x 4 x 16', 6
5. Mud pads, 12" x 12", 8
6. Platforms, 2 x 10 x 12', 4
7. Diagonal braces and toe boards, 1 x 4's, 60'
8. Nails
    a. 8d duplex
    b. 16d duplex
    c. 16d common

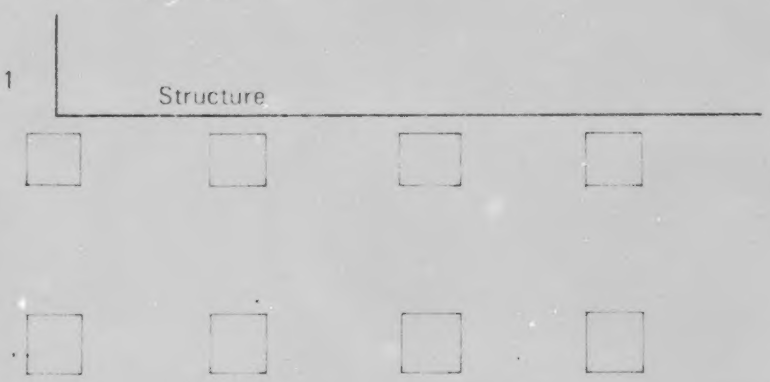
JOB SHEET #2

II. Procedure

A. Set mud pads

1. Place two mud pads at left end of scaffold location about six inches from structure
2. Center two more, roughly three feet from first two
3. Center next two roughly three feet from second two
4. Center last two ten feet from first pair (Figure 1)

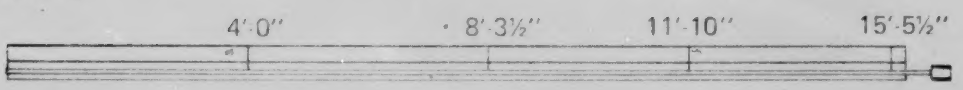
FIGURE 1



B. Construct scaffold supports

1. Lay two sixteen-foot 2 x 4's flat on a level surface with ends flush
2. Use a tape fastened to one end to mark legs at 4'-0", 8'-3 1/2", 11'-10" and 15'-5 1/2" (Figure 2)

FIGURE 2



(NOTE: The 4'-0" end will be the bottom of the support.)

3. Spread 2 x 4's approximately four feet apart

JOB SHEET #2

4. Saw four 2 x 4's 51" long

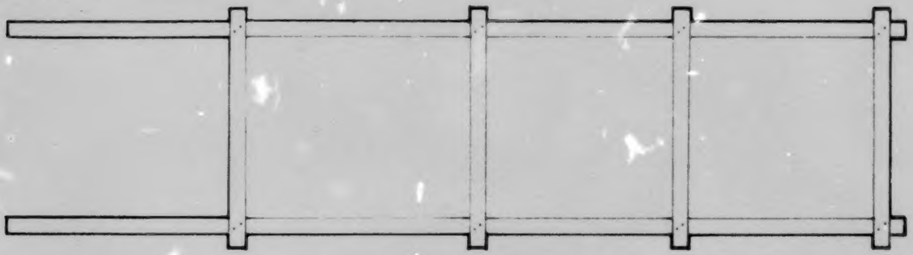
   (NOTE: These are the bearers and putlogs.)

5. Lay out bearers side by side and flush on ends; then place a mark three inches from each end

6. Lay bearers on top of legs with three-inch mark even with outside edge of legs and bottom even with the marks on the legs

7. Use 16d duplex nails to nail bearers to legs; use two nails at each nailing point (Figure 3)

FIGURE 3

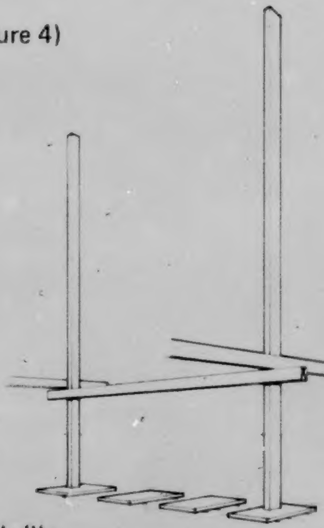


8. Use same procedure to build three more scaffold supports

   (NOTE: Two of the supports will have one 12-foot leg and one 16-foot leg.)

C. Set supports and construct scaffold (Figure 4)

FIGURE 4



1. Place a support on each pair of mud sills

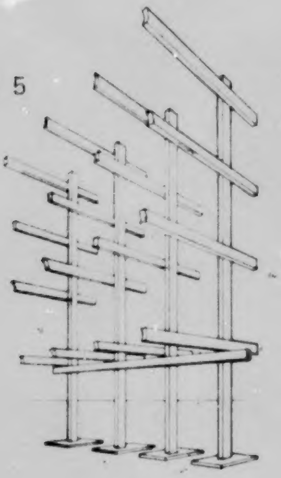
   (NOTE: It will be necessary for two people to hold supports in place until stringers are attached.)

   (CAUTION: Be sure the two with short legs are in the center and short legs are towards the structure.)

JOB SHEET #2

2. Place a mark twelve inches from each end on each stringer
3. Place a stringer so that the marks are even with the outside edge of supports and are pulled up tightly against the undersides of bearers
4. Nail stringer to the two end supports
5. Measure over 3'-4" from center of end supports and place a mark on stringer
6. Nail stringer to support at this point
7. Plumb supports
8. Use same procedure to nail up next stringer (Figure 5)

FIGURE 5

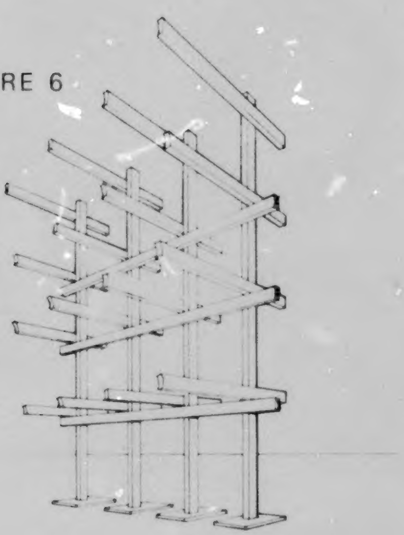


(NOTE: Scaffold will now stand alone.)

JOB SHEET #2

9. Repeat steps two through six and nail up third stringers (Figure 6)

FIGURE 6



(NOTE: Top stringer can be nailed in place after scaffold platform is in place.)

10. Use same procedure as in steps two through nine to complete other side of scaffold

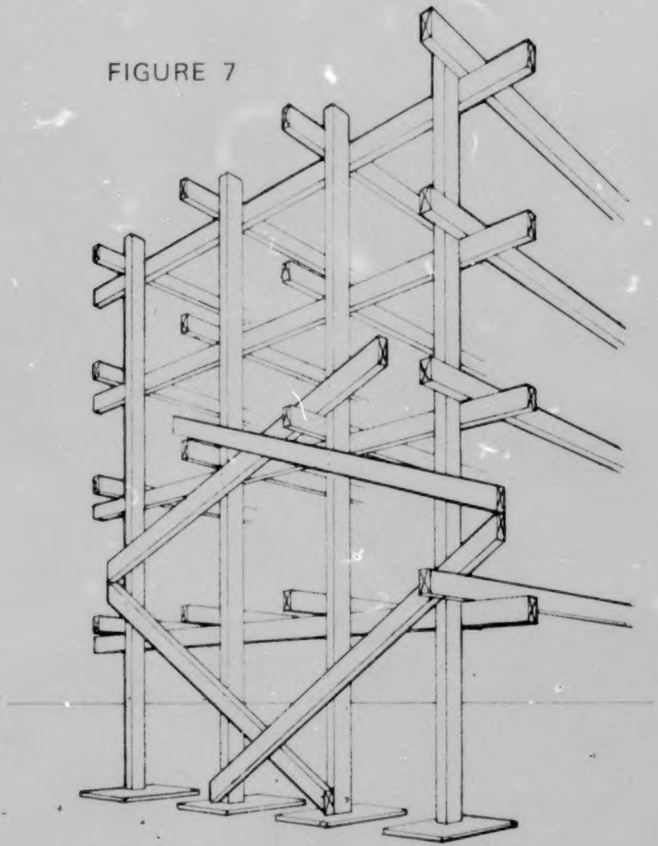
D. Nail on diagonal bracing (Figure 7)

1. On the outside of legs lay one end of 1 x 4 across 3" protrusion of lower bearer of first support and against bottom of third support; nail in place
2. On opposite end of scaffold repeat Step 1, starting with brace nailed at bottom of second support
3. Nail third brace over top of first brace on first support and other end against second bearer on third support

JOB SHEET #2

4. Continue the procedure until all braces are in place

FIGURE 7



E. Construct platform

1. Center 2 x 10 on top of putlogs and nail to each putlog using two 16d common nails at each nailing point

2. Continue this procedure until all four 2 x 10's are nailed down

F. Nail up toe boards and safety rails

1. Nail 1 x 4 against inside of scaffold supports and tightly against platform on the two ends and on the front of scaffold

2. Nail 2 x 4 stringer with top of stringer 3" down from top of supports

   (NOTE: This will be 42" above platform according to OSHA requirements.)

3. Nail midrail centered between top rail and toe board

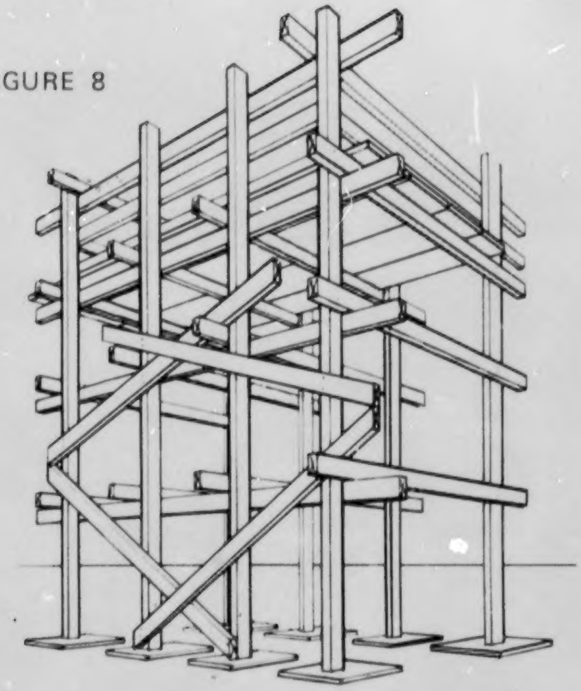
   (NOTE: This is also according to OSHA requirements.)

JOB SHEET #2

4. Place ladder against outside of scaffold and secure at top

(NOTE: Scaffold is now complete and ready for work. See Figure 8. Follow OSHA safety requirements regarding ladders.)

FIGURE 8



SCAFFOLDING
UNIT IV

TEST

NAME ________________________________ SCORE ______________

1. Match the terms on the right to the correct definitions. Place the appropriate numbers in the blanks provided.

______a. Elevated and usually temporary platform for supporting workers, tools, and materials while working on a structure

______b. Type of scaffold normally hung from a structure; used to work high above the ground

______c. Four-inch guardrails to keep tools and materials from falling off scaffold; attached about 1/4" from floor of scaffold

______d. Wheels for scaffolds, usually with brakes

______e. Guardrails attached about 42" high and midway between 42" and toe boards

______f. Scaffold that is built and set up right on the job site

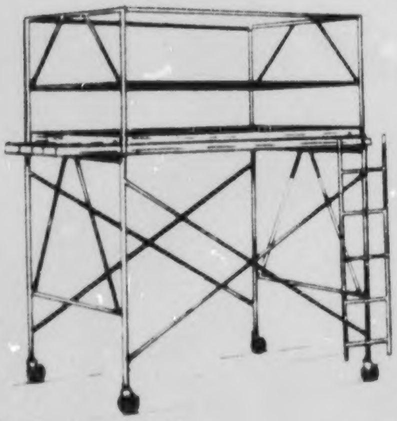
______g. Angle-shaped devices manufactured to fasten to the forms; support a platform for workers and materials

______h. Short members on which the flooring of a scaffold is laid

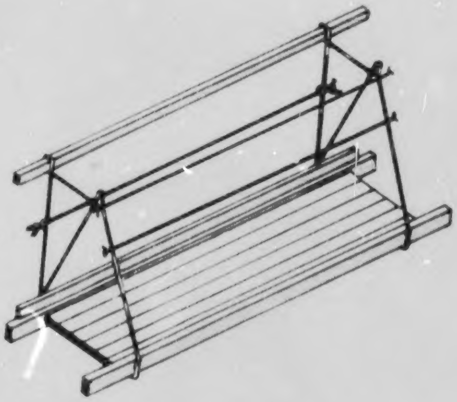
______i. Any small member which is used primarily to support another member or structure

1. Casters
2. Safety rails
3. Scaffold
4. Swinging scaffold (stage)
5. Toe boards
6. Scaffold jacks
7. Job-built scaffold
8. Bearer
9. Putlog

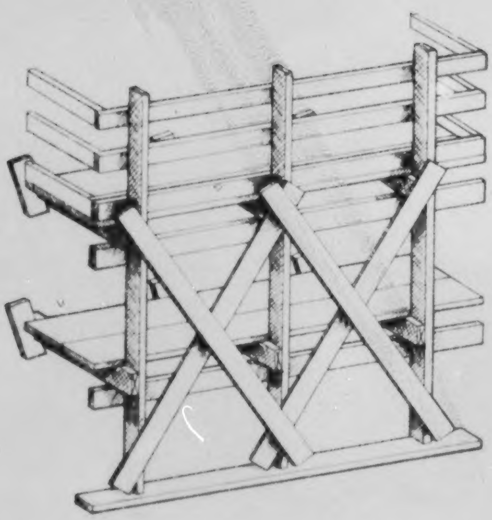
2. Identify types of scaffolds below by writing the correct names in the blanks provided.



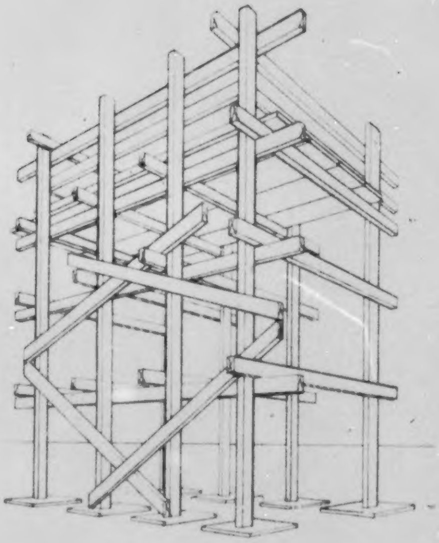
a. ______________________________



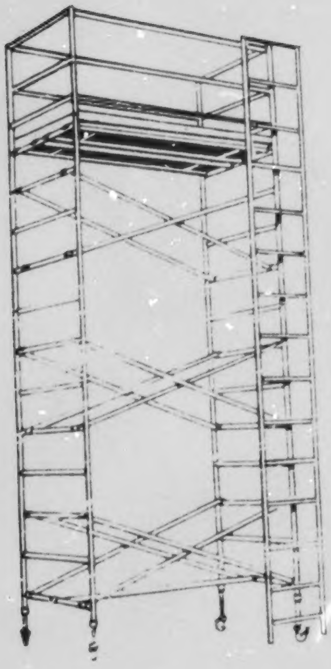
b. ______________________________



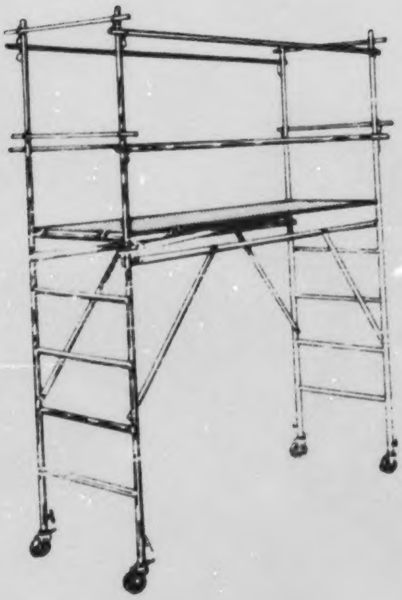
c. ______________________________



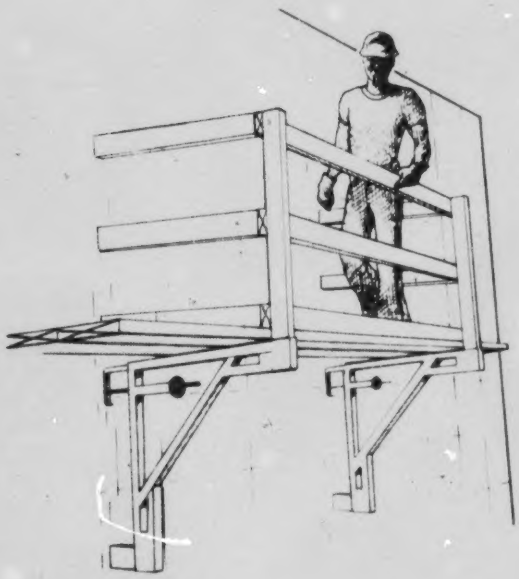
d. ______________________________



e. ______________________

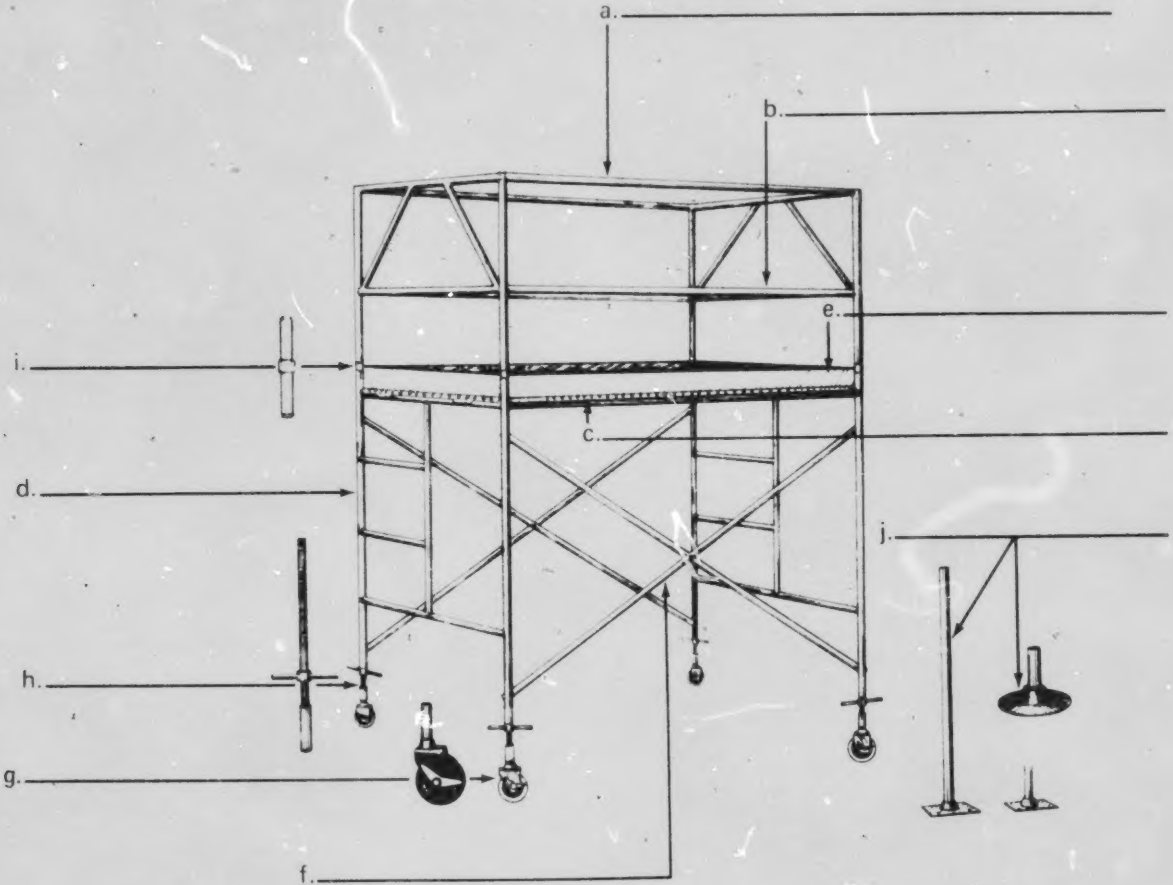


f. ______________________



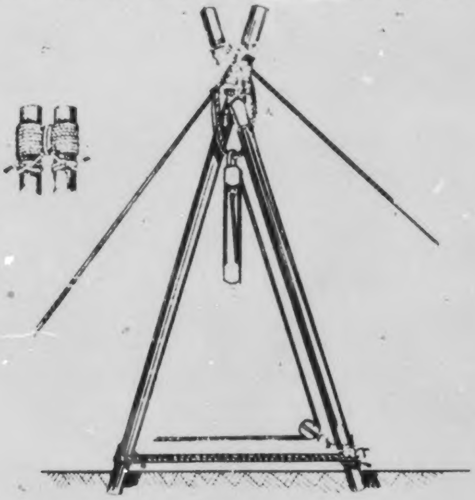
g. ______________________

3. Identify the parts of a prefabricated rolling scaffold by writing the correct names in the blanks provided.

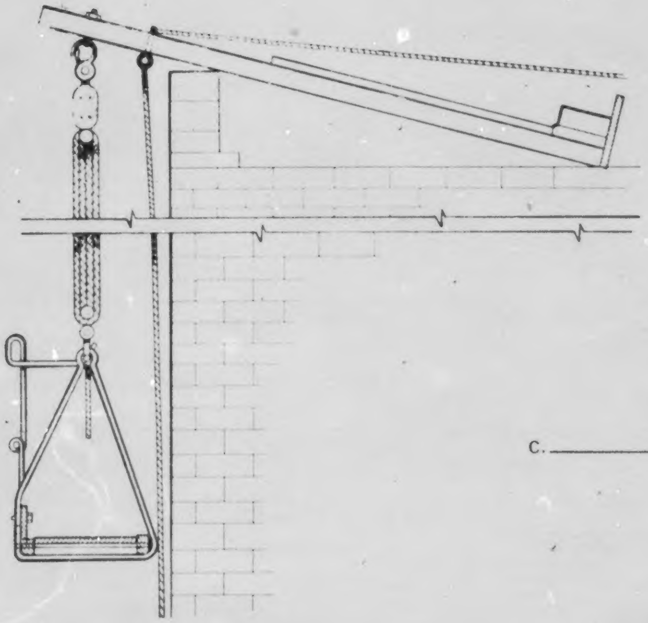


4. Identify the swinging scaffold rigged for a job by placing an "X" in the correct blank.

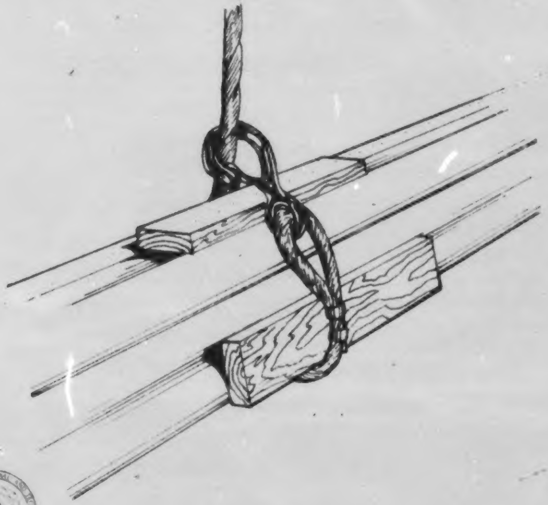
a. ____________________



b. ____________________



c. ____________________



5. Select from the list below safety tips for scaffolding by placing an "X" in the correct blanks.

   _____a. Be sure to remove brakes

   _____b. Block up legs to level scaffold

   _____c. Tie off scaffolds about every twenty-five feet when they are built several sections high

   _____d. Throw tools down when finished with them

   _____e. Be sure all planking or work boards are sound

   _____f. Do not use damaged scaffolds

   _____g. Do not try to overreach scaffold

   _____h. Be sure brakes are set

   _____i. Take safety rails off so you can reach farther

   _____j. Do not throw objects to and/or from scaffold

   _____k. Do not alter or disturb scaffolds while in use

   _____l. Use all three safety rails

   _____m. Do not use blocking under legs

   _____n. Work under scaffolds during storms

   _____o. Do not work on scaffolds during storms, high winds, or when scaffolds are covered with snow and ice

6. Demonstrate the ability to:

   a. Set up section of scaffold with safety rails.

   b. Build a double pole scaffold.

   (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

SCAFFOLDING
UNIT IV

ANSWERS TO TEST

1. a. 3
   b. 4
   c. 5
   d. 1
   e. 2
   f. 7
   g. 6
   h. 9
   i. 8
2. a. Prefabricated steel scaffold
   b. Swinging scaffold
   c. Single-pole job-built wood scaffold
   d. Double-pole job-built wood scaffold
   e. Prefabricated aluminum ladder scaffold
   f. Adjustable steel rolling scaffold
   g. Scaffold jacks with platform
3. a. Top guardrail
   b. Mid guardrail
   c. Metal scaffold plank
   d. End frame
   e. Toe board
   f. Cross brace
   g. Caster
   h. Screw jack
   i. Coupling pin
   j. Base plates
4. b
5. c, e, f, g, h, j, k, l, m, o
6. Performance skills evaluated to the satisfaction of the instructor

COMMERCIAL CARPENTRY
PROGRESS CHART

Section C
Related Information

Student's Name

	UNIT I LUMBER			UNIT II MEASURING				UNIT III HARDWARE AND FASTENERS				UNIT IV SCAFFOLDING								
	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4					
Job	UNIT TEST	Compute Board Feet	Compute Cost of Materials	UNIT TEST	Read a Rule	Measure Objects	Draw Lines and Objects	UNIT TEST				UNIT TEST	Set Up Section of Scaffold with Safety Rails	Build Double Pole Scaffold						
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

	85% Correct	85% Correct	85% Correct	85% Correct	Nearest 1/16 of an inch	Nearest 1/16 of an inch	85% Correct	85% Correct				85% Correct	To Satisfaction of Instructor	To Satisfaction of Instructor						
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Section D
Tools

HAND TOOLS
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to list basic rules concerning safe use and care of hand tools. The student should be able to identify basic and miscellaneous tools common to the carpentry trade and match the tools to their intended uses. This knowledge will be evidenced by completion of the unit test with a minimum of 100 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with hand tools to the correct definitions.
2. List basic rules concerning the safe use of hand tools.
3. List basic rules concerning the care of hand tools.
4. List basic carpentry tools.
5. Identify types of hammers used in carpentry.
6. Match carpentry hammers to their uses.
7. Identify types of handsaws used by carpenters.
8. Match types of handsaws to their uses.
9. Identify types of measuring instruments.
10. Identify types of squares.
11. Match types of squares to their uses.
12. Identify types of leveling and plumbing instruments.
13. Identify types of wood planes.
14. Match types of wood planes to their uses.
15. Identify types of boring and drilling tools.
16. Identify types of screwdrivers.
17. Identify types of pliers used by carpenters.
18. Identify types of wrenches.
19. Identify types of files.

20. Identify types of chisels.
21. Identify types of clamps.
22. Identify miscellaneous tools used by carpenters.

HAND TOOLS
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide student with objective sheet.

   B. Provide student with information sheet.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Have students demonstrate the ability to use each tool safely and according to the recommended use.

   G. Suggest that students buy good grade of tools and not be impressed with the price of the cheaper grades.

   H. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Basic Carpentry Tools

      2. TM 2--Basic Carpentry Tools (Continued)

      3. TM 3--Types of Hammers

      4. TM 4--Types of Handsaws

      5. TM 5--Types of Measuring Instruments

      6. TM 6--Types of Squares

      7. TM 7--Types of Leveling and Plumbing Instruments

      8. TM 8--Types of Wood Planes

      9. TM 9--Types of Drilling and Boring Tools

      10. TM 10--Types of Screwdrivers

      11. TM 11--Types of Pliers

12. TM 12--Types of Wrenches
13. TM 13--Types of Files
14. TM 14--Types of Chisels
15. TM 15--Types of Clamps
16. TM 16--Miscellaneous Tools
17. TM 17--Miscellaneous Tools (Continued)
18. TM 18--Miscellaneous Tools (Continued)
19. TM 19--Miscellaneous Tools (Continued)
20. TM 20--Miscellaneous Tools (Continued)

D. Test

E. Answers to test

III. Unit references:

A. Association of General Contractors. *Task Analysis of Residential Carpentry.* Denver, Colorado: Association of General Contractors, 1972.

B. Hammond, James J. et al. *Woodworking Technology.* Bloomington, Illinois: McKnight and McKnight Publishing Company, Inc., 1968.

C. Wagner, Willis H. *Modern Carpentry.* Homewood, Illinois: Goodheart-Wilcox Company, Inc., 1968.

D. Diehl, Donald W., and Patton, Bob. *Commercial Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center and Associated General Contractors of America, 1975.

E. *Goldblatt Tool Catalog.* Kansas City, Kansas: Goldblatt Tool Company, 1975.

F. *Gates Hardware and Supplies: General Catalog.* Gates Hardware and Supply Company, Brady and Elgin Streets, Tulsa, Oklahoma 74120.

HAND TOOLS
UNIT I

INFORMATION SHEET

I. Terms and definitions

- A. Joinery--Term referring to various types of joints used in woodworking
- B. Miter box--Device used to hold molding and trim and to guide saw at proper angle when cutting miter joints
- C. Molding--Strip of wood, plastic, or metal, plain or curved, formed into long regular channels or projections; used for decorative purposes
- D. Calibrated--Graduations or marks giving direct figures
- E. Rafter and brace table--Table giving direct length per foot of run for a large variety of rafters and braces
- F. Miter--Ends of two pieces of wood of corresponding form which are cut off at an angle and fitted together in angular shape
- G. Scribe--Tool used to scratch or mark hard surfaces

II. Basic rules concerning the safe use of hand tools

- A. Use the correct tool for the job
- B. Do not use dull or broken tools
- C. Do not throw tools
- D. Keep fingers away from edges of cutting tools and work away from your body
- E. Be sure that tool handles are in good condition and are securely fastened to body of tool

III. Basic rules concerning the care of hand tools

- A. Keep hand tools sharp
- B. Protect the cutting edge of tools when not in use
- C. Keep tools dry and lightly oiled when not in use
- D. Use tools only for the purposes for which they were intended

INFORMATION SHEET

IV. Basic carpentry tools (Transparencies 1 and 2)

   A. Hammer

   B. Handsaw

   C. Rule

   D. Square

   E. Level

   F. Plane

   G. Brace and bit

   H. Screwdriver

   I. Pliers

   J. Adjustable wrench

   K. File

   L. Chisel

   M. Knife

V. Types of hammers used in carpentry (Transparency 3)

   A. Claw hammers

      1. Curved claw

         (NOTE: This hammer can easily be identified by its curved claw. It can have either a wood, fiberglass, or steel handle and weighs 13-20 ounces.)

      2. Straight claw

         (NOTE: This hammer can easily be identified by its straight claw. It ranges in size from 16 to 28 ounces.)

   B. Sledge hammer

      (NOTE: The sledge hammer is a large hammer, having a balanced head with two identical faces. The sizes are from 2 to 20 pounds.)

INFORMATION SHEET

C. Half hatchet

(NOTE: The half hatchet has a short handle with a hammer surface on one half of the head and a sharp surface on the other half of the head. There is a slot on the side of the blade which is used for pulling or drawing nails.)

VI. Uses of carpentry hammers

A. Curved claw hammer--Driving and drawing nails

(NOTE: The thirteen-ounce hammer is considered a finishing hammer. The sixteen-ounce hammer is a general purpose hammer.)

B. Straight claw hammer--Driving and drawing nails

(NOTE: The twenty-eight-ounce hammer is considered a framing hammer.)

C. Sledge hammer--Driving stakes

D. Half hatchet

1. Sharpening stakes
2. Trimming framing members
3. Nailing

VII. Types of handsaws used by carpenters (Transparency 4)

A. Crosscut saw

(NOTE: This saw is 20-26 inches in length with 4-12 points per inch. The teeth are filed at an angle across the face.)

B. Rip saw

(NOTE: This saw is 20-28 inches in length and with five to seven points per inch. The teeth are filed square across the face.)

C. Back saw (miter box saw)

(NOTE: This saw is 12-28 inches in length and with eleven points per inch. The back saw has fine teeth and a thin blade. It has a heavy metal band across the back to strengthen the thin blade.)

D. Coping saw

(NOTE: This saw has a U-shaped saw frame which permits up to 6 1/2" deep cuts. This saw also has a replaceable blade.)

INFORMATION SHEET

E. Compass saw (keyhole saw)

(NOTE: This saw is 12-14 inches long with a tapered blade. The blade is sometimes replaceable with different size blades. The adjustable blade can be set at several positions.)

F. Hacksaw

(NOTE: This saw has a U-shaped saw frame with a replaceable blade.)

VIII. Uses of handsaws

A. Crosscut saw--Cuts across the grain of wood

B. Rip saw--Cuts with the grain of wood

C. Back saw (miter box saw)

1. Makes fine cuts for joinery
2. Is used in a miter box

D. Coping saw

1. Cuts curves
2. Shapes ends of molding for joints and for scroll work

E. Compass saw (keyhole saw)

1. Cuts gentle curves
2. Cuts inside corners

F. Hacksaw--Cuts all types of metal

IX. Types of measuring instruments (Transparency 5)

A. Bench rule

B. Folding rule

C. Steel tape

X. Types of squares (Transparency 6)

A. Framing square (rafter square)

(NOTE: This square has a twenty-four-inch calibrated blade and a sixteen-inch calibrated tongue. Rafter and brace tables are stamped on the blade.)

INFORMATION SHEET

B. Combination square

(NOTE: This square has a twelve-inch blade and an adjustable handle which usually contains a leveling bubble and a scribe. The handle has 90° and 45° sides.)

C. Sliding T bevel

(NOTE: This square has a solid steel or wood handle and an adjustable metal blade.)

XI. Uses of squares

A. Framing square (rafter square)--General framing procedures for layout of walls, partitions, rafters, braces, and stairs

B. Combination square

1. General purpose squaring

2. 45° miter marking instrument

C. Sliding T bevel

1. Measure or transfer angles from 0° to 180°

2. Check a miter cut

XII. Types of leveling and plumbing instruments (Transparency 7)

A. Spirit level

B. Torpedo level

C. Line level

D. Builder's level

E. Plumb bob

F. Water level

G. Laser beam level

XIII. Types of wood planes (Transparency 8)

A. Jack plane

(NOTE: This plane is fourteen inches long and two inches wide.)

B. Block plane

(NOTE: This plane is 4" - 6" long and 1 3/8" - 1 5/8" wide.)

INFORMATION SHEET

- C. Rabbet plane

  (NOTE: This plane is 4" - 8 1/2" long and 1 1/16" -1 1/2" wide.)

XIV. Uses of wood planes

- A. Jack plane--General purposes
- B. Block plane--Small jobs, such as trim and end grain
- C. Rabbet plane
  - 1. Corners
  - 2. Hard-to-get-to places

XV. Types of boring and drilling tools (Transparency 9)

- A. Boring tools
  - 1. Carpenter's brace
  - 2. Auger bit
  - 3. Flat bit (speed bit)
- B. Drilling tools
  - 1. Hand drill
  - 2. Push drill
  - 3. Twist drill

XVI. Types of screwdrivers (Transparency 10)

- A. Common (flat blade)
- B. Phillips
- C. Bits for carpenter's brace
- D. Automatic
- E. Offset with common and phillips bits

XVII. Types of pliers used by carpenters (Transparency 11)

- A. Combination slip-joint
- B. Side cutting

INFORMATION SHEET

- C. Channel-lock
- D. Needle nose

XVIII. Types of wrenches (Transparency 12)

- A. Box-end
- B. Open-end
- C. Combination
- D. Adjustable
- E. Pipe
- F. Hex key (Allen wrench)

XIX. Types of files (Transparency 13)

- A. Flat
- B. Round
- C. Half round
- D. Triangular (three square)
- E. Knife
- F. Square
- G. Slitting
- H. Cant saw

XX. Types of chisels (Transparency 14)

- A. Wood
- B. Cold
- C. Brick
- D. Stripping
- E. Floor chisel (straight blade)
- F. Ripping chisel

INFORMATION SHEET

XXI. Types of clamps (Transparency 15)

- A. Bar
- B. Hand screw
- C. C
- D. Spring
- E. Band (strap)

XXII. Miscellaneous tools used by carpenters (Transparencies 16, 17, 18, 19, and 20)

- A. Dividers
- B. Nail sets
- C. Chalk line and reel
- D. Tin snips
- E. Star drill
- F. Point
- G. Miter box and saw
- H. One hundred foot tape
- I. Ratchet wrench and socket
- J. Taps and tap wrenches
- K. Utility knife
- L. Drill bit
- M. Putty knife
- N. Bolt cutters
- O. Pry bar (crow bar)
- P. Wood rasp
- Q. Nail claw
- R. Bench brush
- S. Carbide sharpening stone

INFORMATION SHEET

T. Saw buck (saw horse)

U. Step ladder

V. Single ladder (nonskid)

W. Extension ladder (nonskid)

X. Hand broom

Y. Push broom

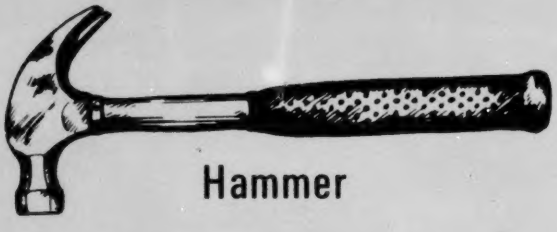
Z. Sharp shooter

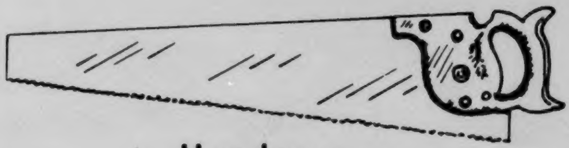
AA. Sand scoop

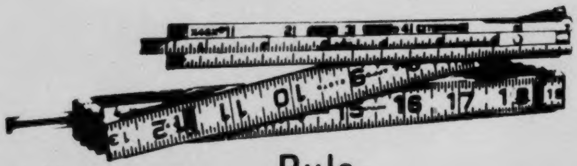
BB. Long handled square point shovel

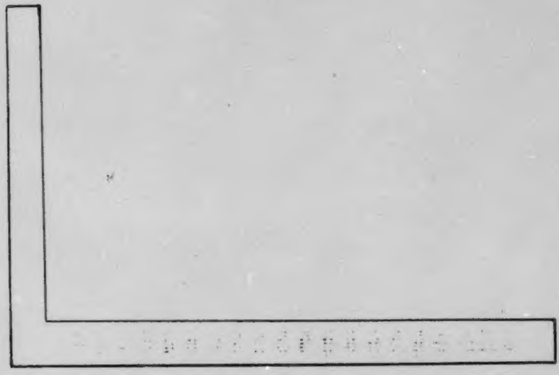
CC. Long handled round point shovel

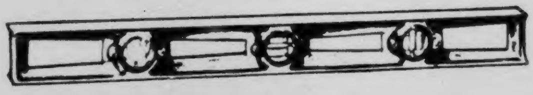
Basic Carpentry Tools

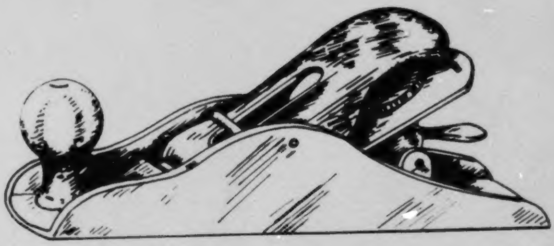

Hammer

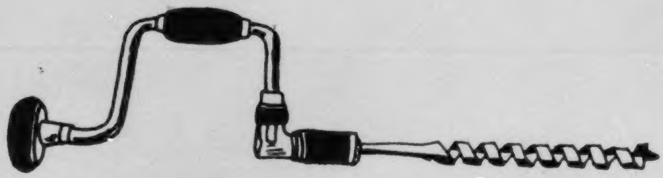

Handsaw


Rule


Square

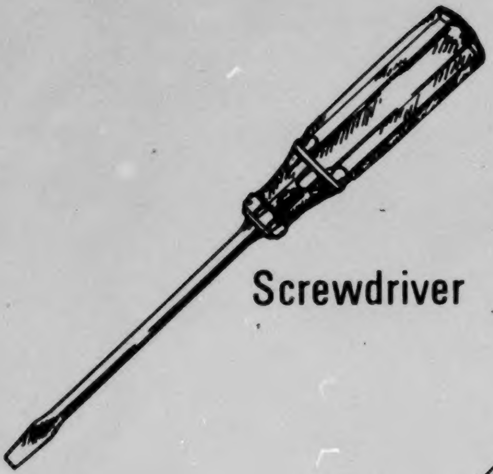

Level


Plane

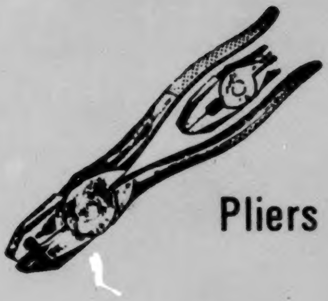

Brace And Bit

Basic Carpentry Tools

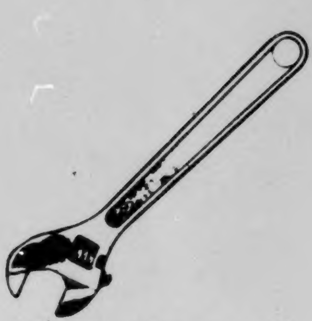
(Continued)



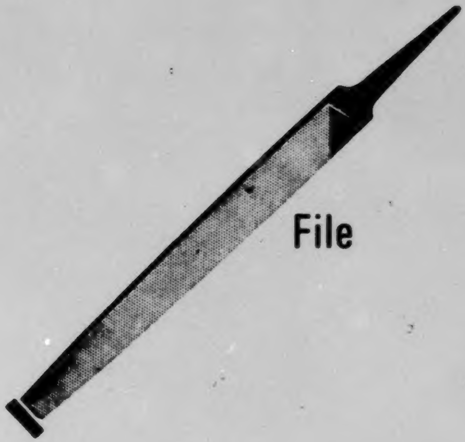
Screwdriver



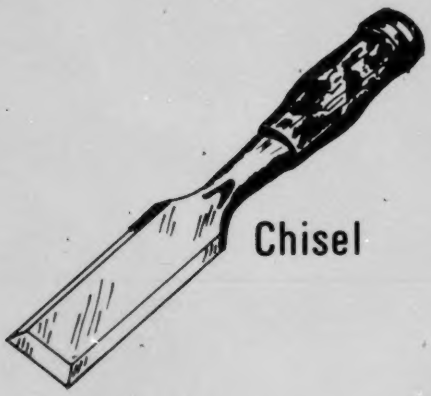
Pliers



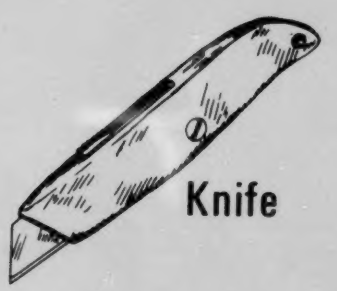
Adjustable Wrench



File

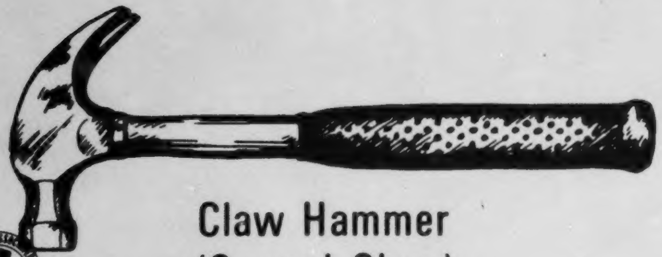


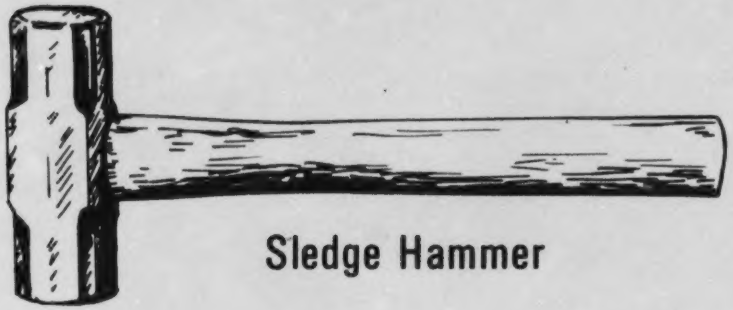
Chisel

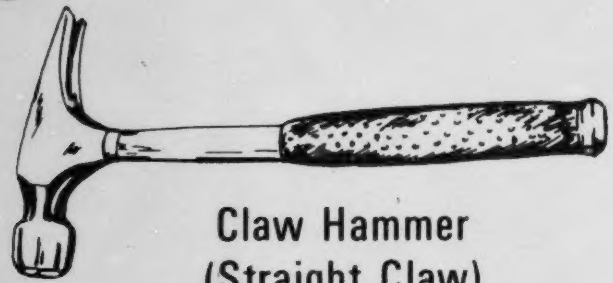


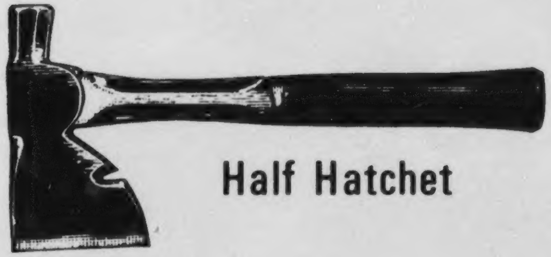
Knife

Types of Hammers

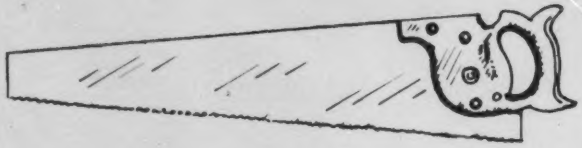

Claw Hammer
(Curved Claw)

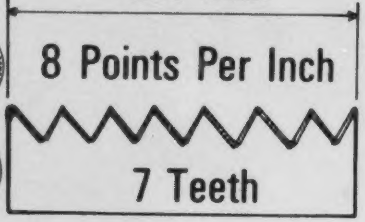

Sledge Hammer


Claw Hammer
(Straight Claw)


Half Hatchet

Types of Handsaws



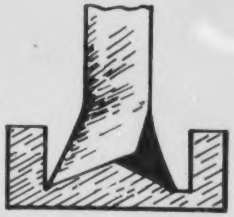


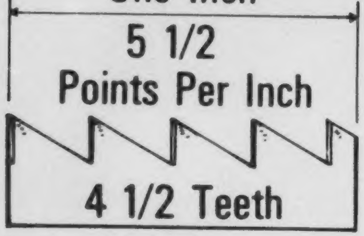
One Inch

8 Points Per Inch

7 Teeth

Crosscut Saw



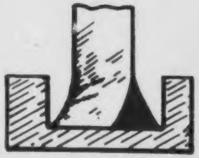


One Inch

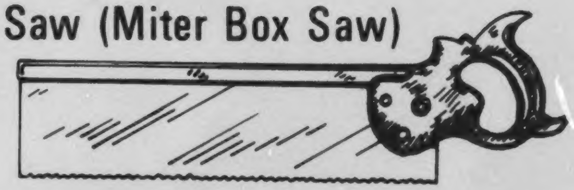
5 1/2
Points Per Inch

4 1/2 Teeth

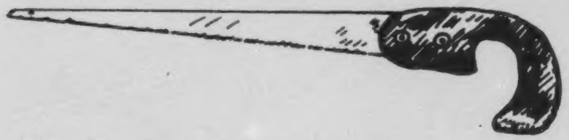
Rip Saw



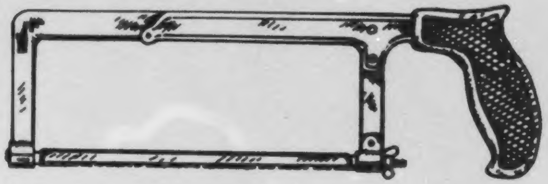
Back Saw (Miter Box Saw)



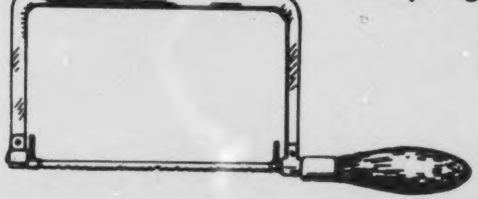
Compass Saw (Keyhole Saw)



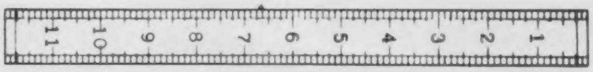
Hacksaw



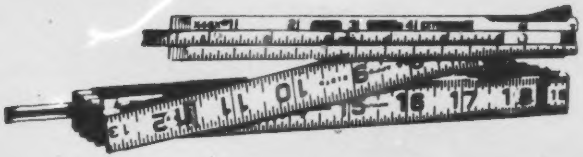
Coping Saw



Types of Measuring Instruments


11
10
9
8
7
6
5
4
3
2
1

Bench Rule


13
12
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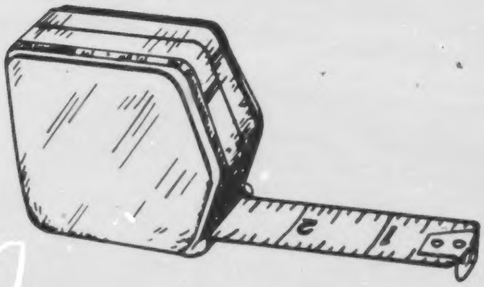
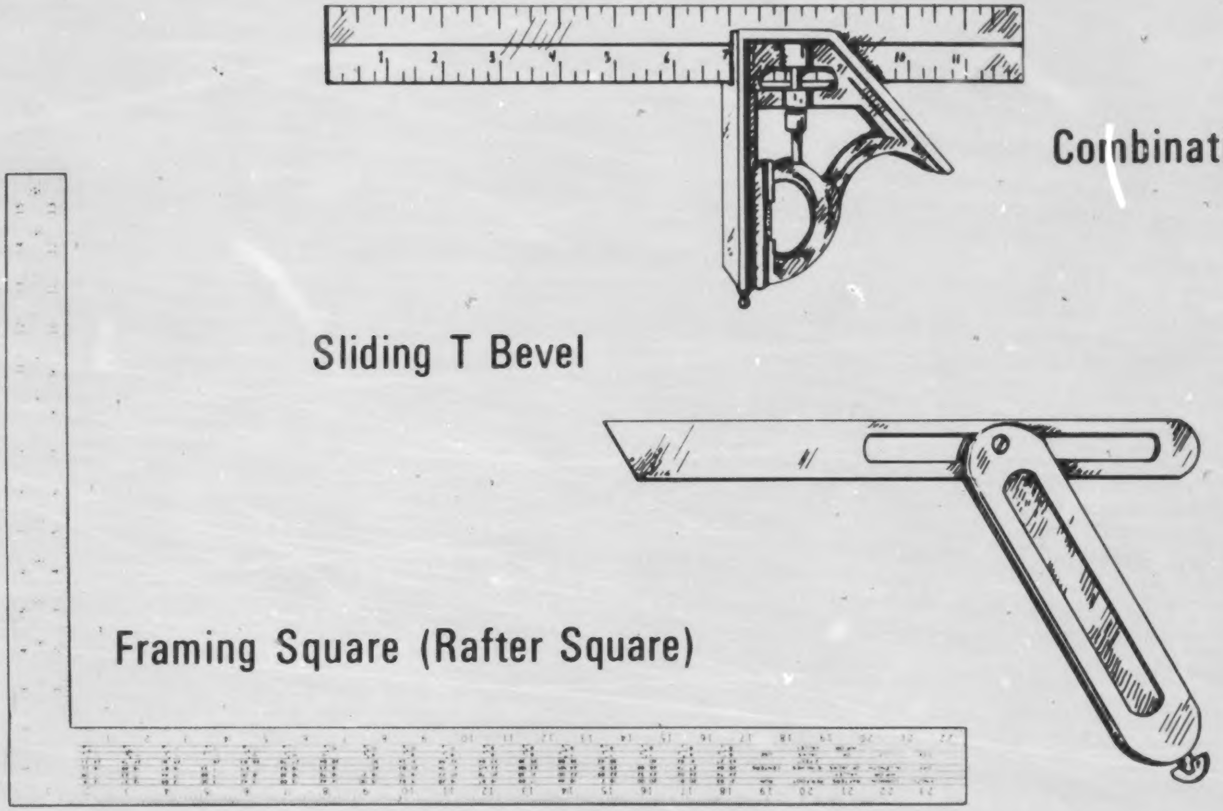
15
16
17
18

Folding Rule



Steel Tape

Types of Squares



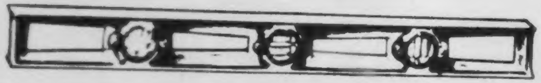
Combination Square

Sliding T Bevel

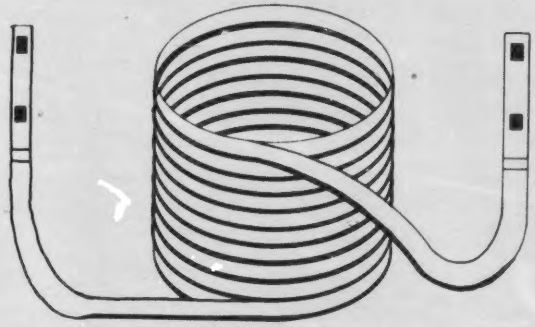
Framing Square (Rafter Square)

Types of Leveling and Plumbing Instruments

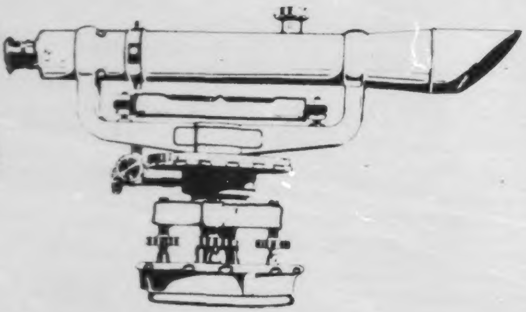
LEVELS



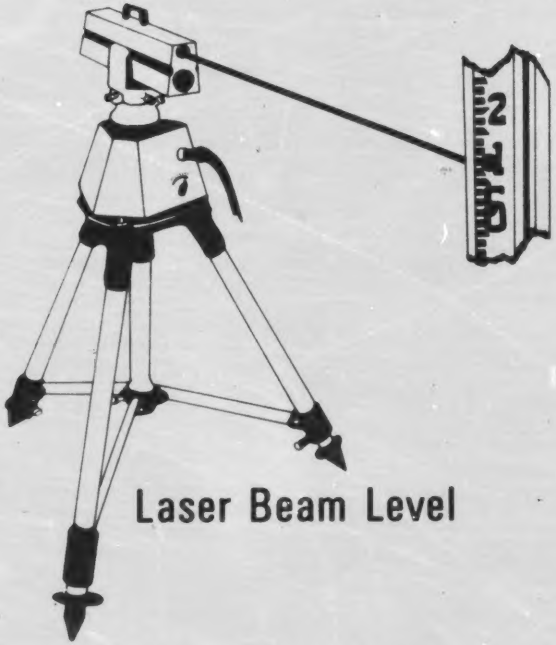
Spirit



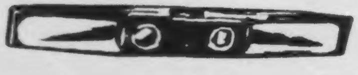
Water Level



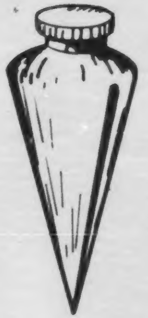
Builder's



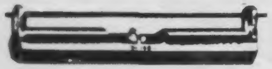
Laser Beam Level



Torpedo



Plumb Bob

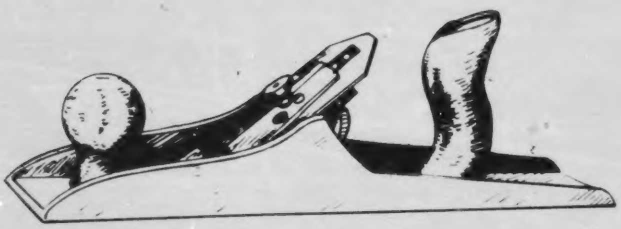


Line

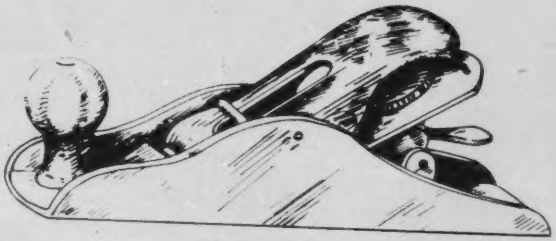
TM 7

CC - 27-D

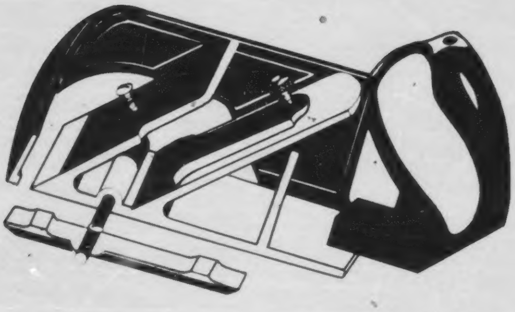
Types of Wood Planes



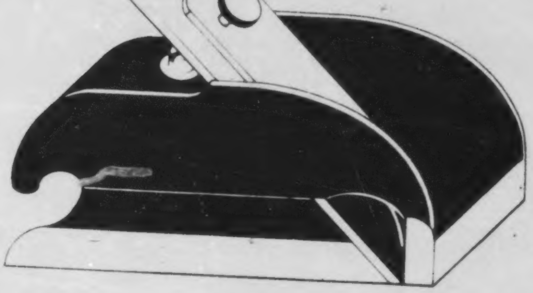
Jack Plane



Block Plane



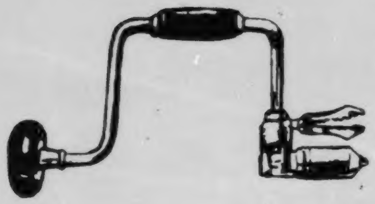
Rabbet Plane



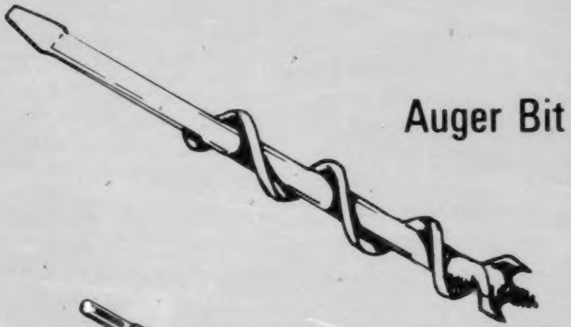
Rabbet Plane

Types of Drilling and Boring Tools

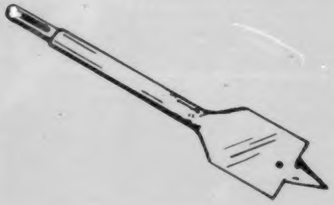
BORING TOOLS



Carpenter's Brace



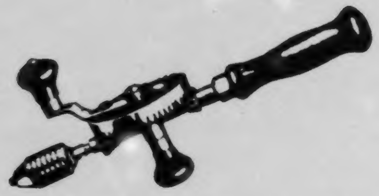
Auger Bit



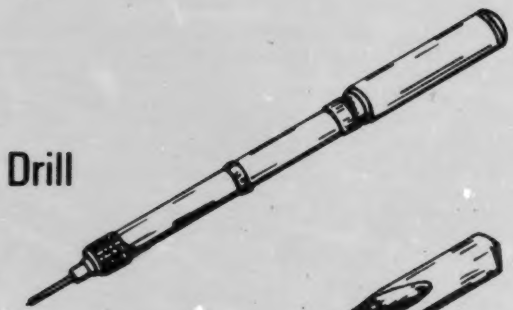
Flat Bit
(Speed Bit)

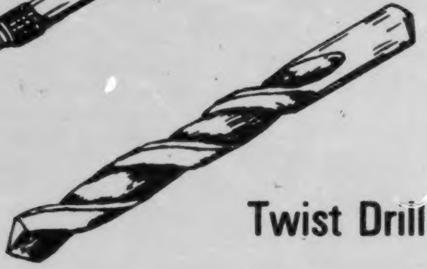
DRILLING TOOLS

Hand Drill



Push Drill



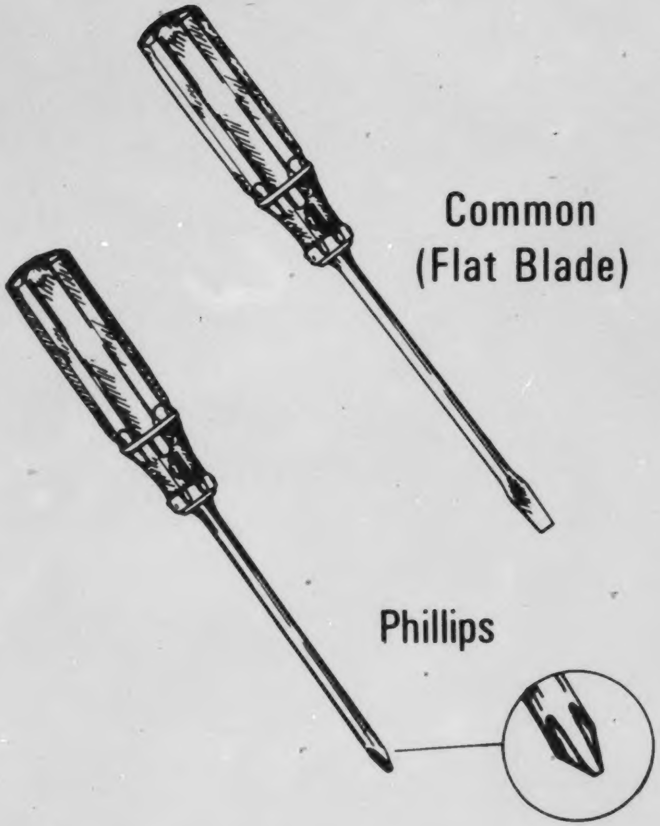


Twist Drill

TM 9

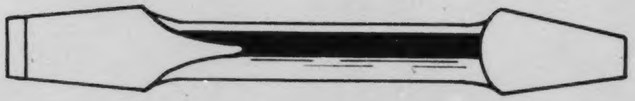
CE 31-D

Types of Screwdrivers

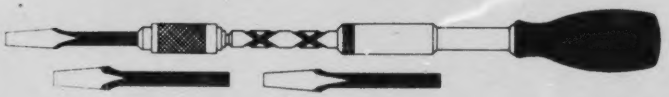


Common
(Flat Blade)

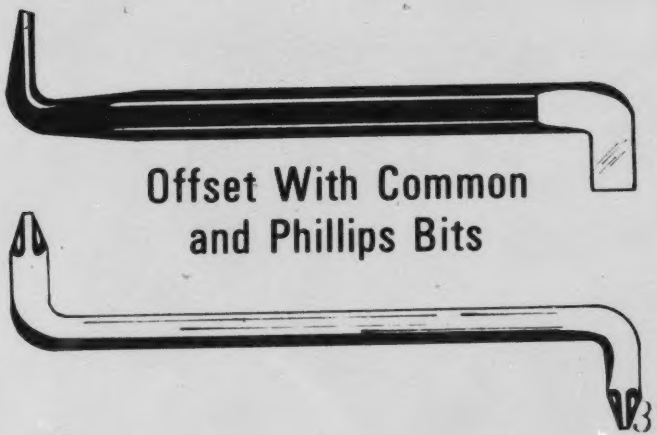
Phillips



Bit for Carpenter's Brace



Automatic

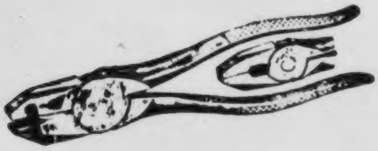


Offset With Common
and Phillips Bits

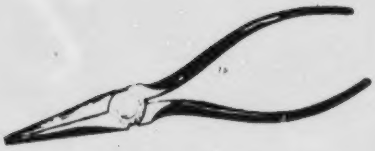
TM 10

CC - 33-D

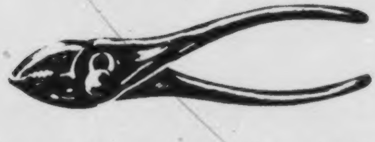
Types of Pliers



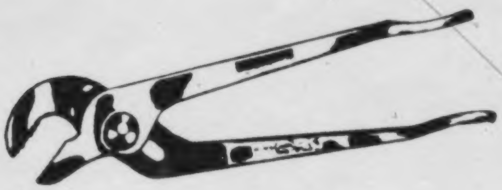
Side Cutting



Needle Nose

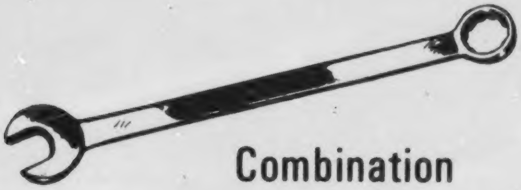


Combination Slip-Joint

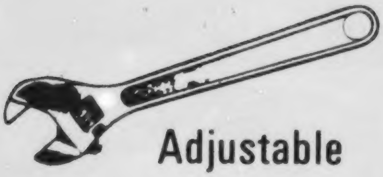


Channel-Lock

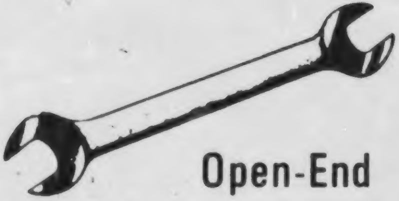
Types of Wrenches



Combination

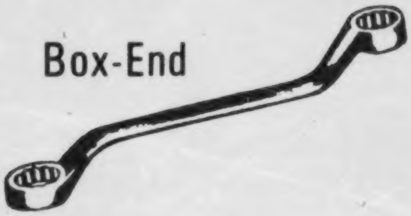


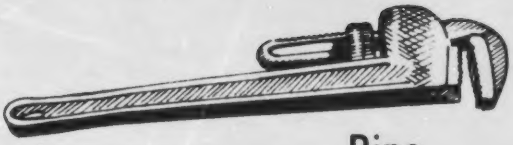
Adjustable



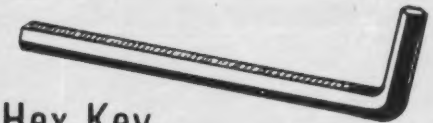
Open-End

Box-End



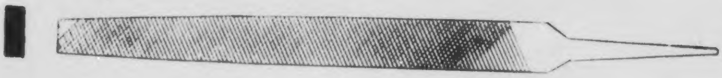


Pipe

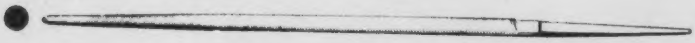


Hex Key
(Allen Wrench)

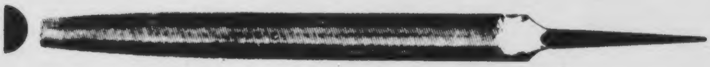
Types of Files



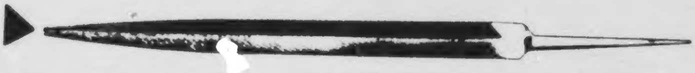
Flat



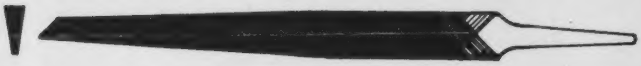
Round



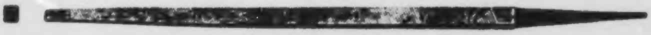
Half Round



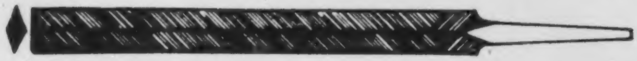
Triangular (Three Square)



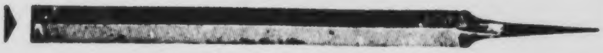
Knife



Square

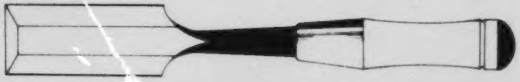


Slitting

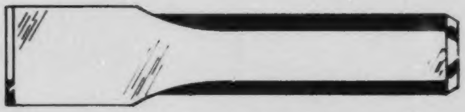


Cant Saw

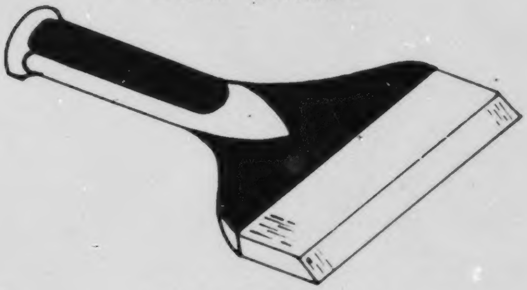
Types of Chisels



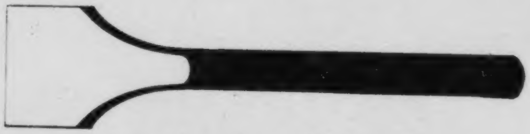
Wood Chisel



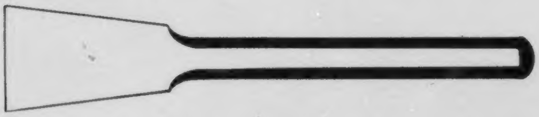
Cold Chisel



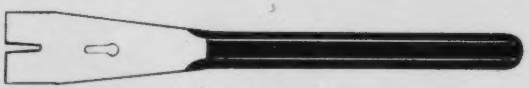
Brick Chisel



Stripping Chisel

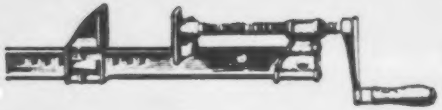


Floor Chisel (Straight Blade)



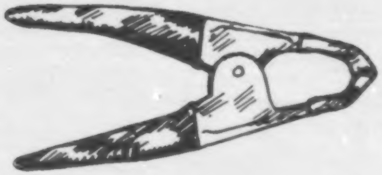
Ripping Chisel

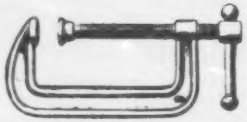
Types of Clamps



Bar

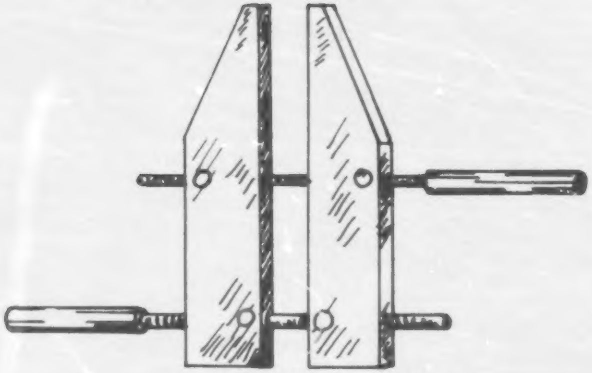
Spring

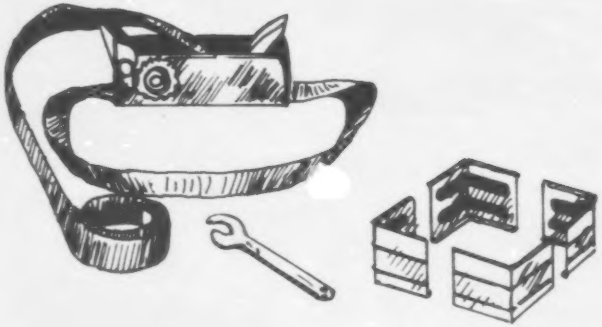




C

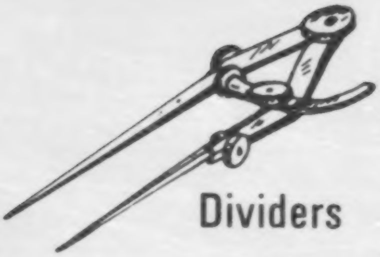
Hand Screw



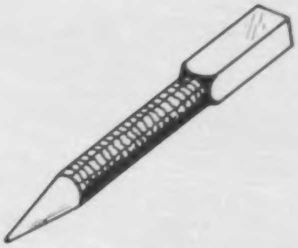


Band (Strap)

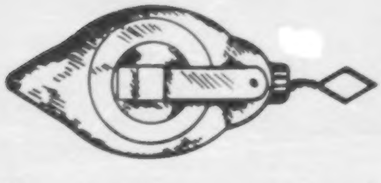
Miscellaneous Tools



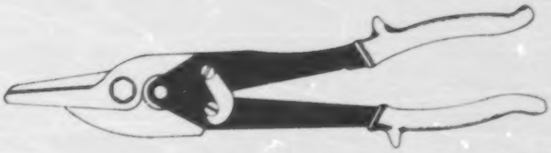
Dividers



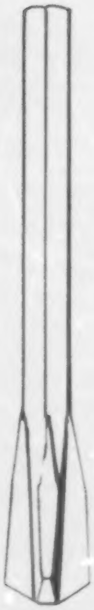
Nail Sets



Chalk Line and Reel

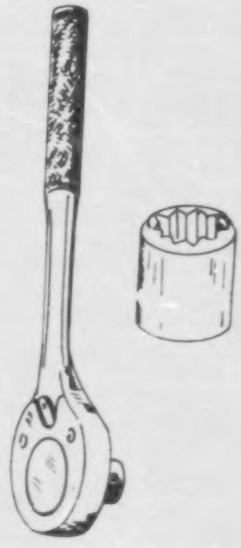


Tin Snips



Star Drill

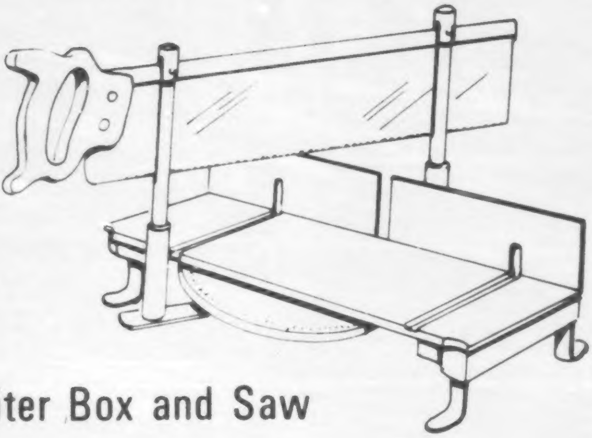
Point



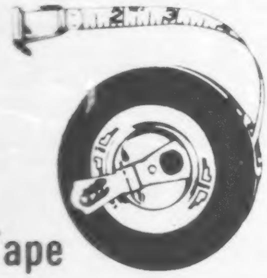
Ratchet Wrench and Socket

Miscellaneous Tools

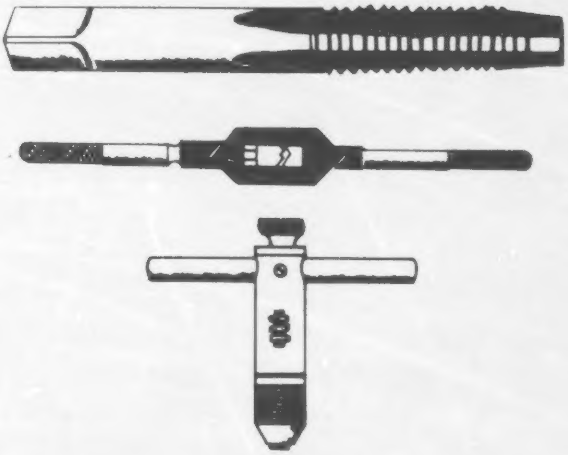
(Continued)



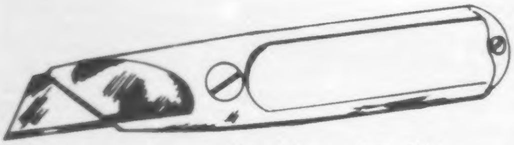
Miter Box and Saw



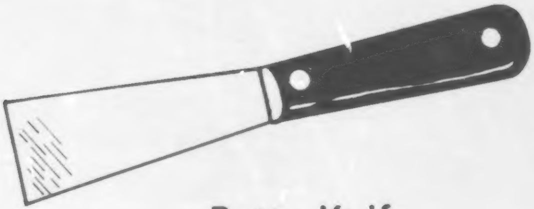
100′ Tape



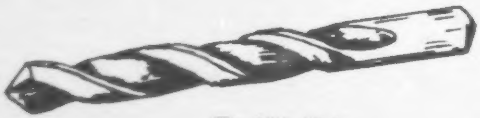
Taps and Tap Wrenches



Utility Knife



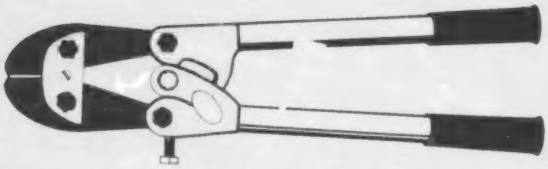
Putty Knife



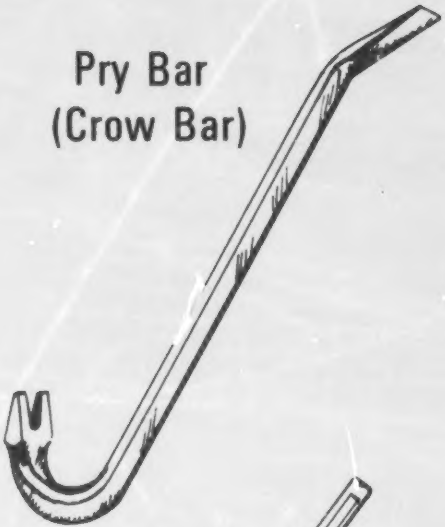
Drill Bit

Miscellaneous Tools

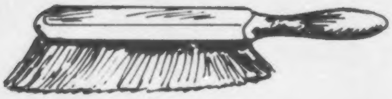
(Continued)



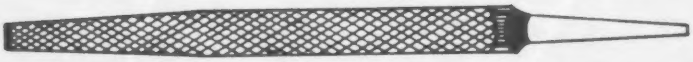
Bolt Cutters



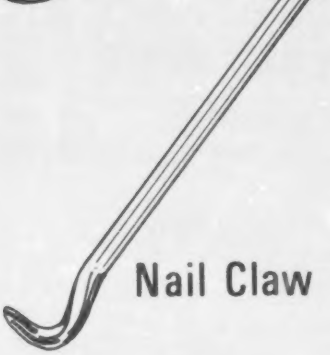
Pry Bar
(Crow Bar)



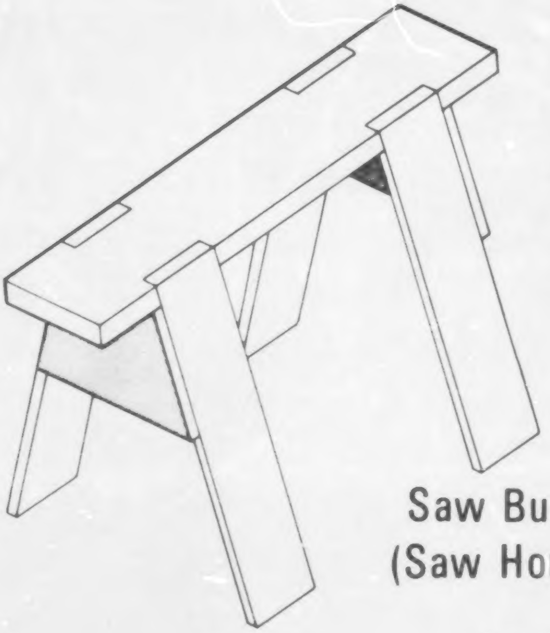
Bench Brush



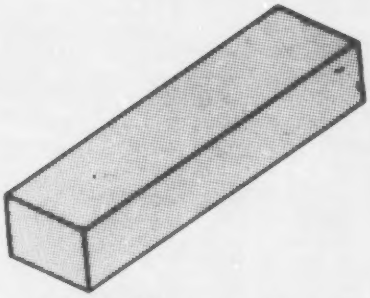
Wood Rasp



Nail Claw

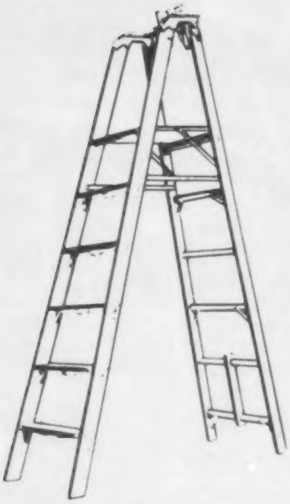


Saw Buck
(Saw Horse)

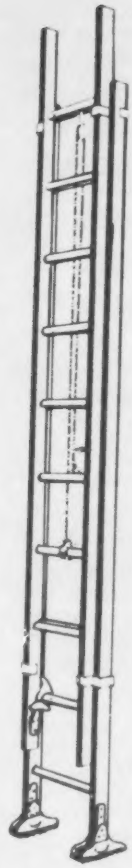


Carbide Sharpening Stone

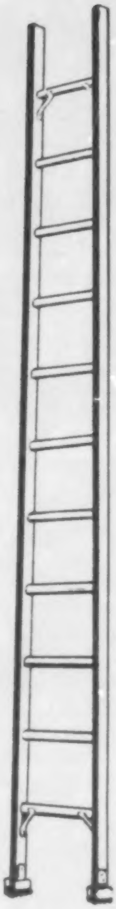
Miscellaneous Tools
(Continued)



Step Ladder



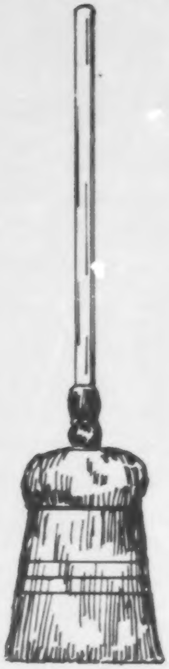
Extension Ladder
(Nonskid)

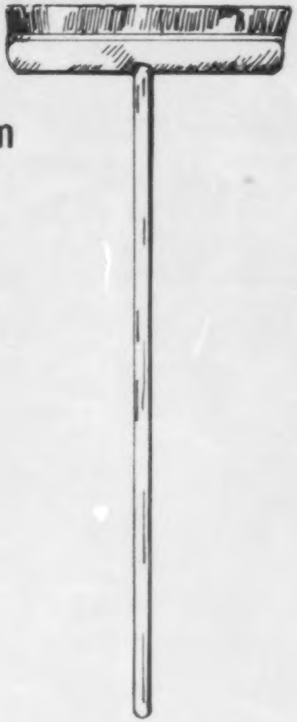


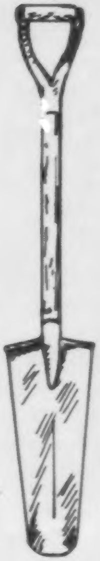
Single Ladder
(Nonskid)

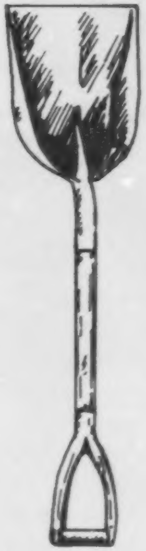
Miscellaneous Tools

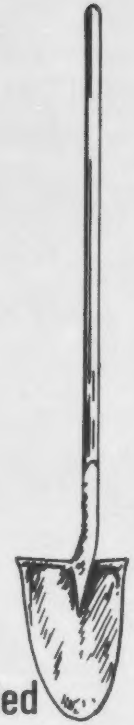
(Continued)

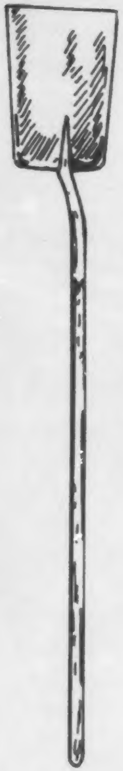

Hand Broom


Push Broom


Sharp Shooter


Sand Scoop


Long Handled
Round Point Shovel


Long Handled
Square Point Shovel

HAND TOOLS
UNIT I

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Term referring to various types of joints used in woodworking

______b. Device used to hold molding and trim and to guide saw at proper angle when cutting miter joints

______c. Strip of wood, plastic, or metal, plain or curved, formed into long regular channels or projections; used for decorative purposes

______d. Graduations or marks giving direct figures

______e. Table giving direct length per foot of run for a large variety of rafters and braces

______f. Ends of two pieces of wood of corresponding form which are cut off at an angle and fitted together in angular shape

______g. Tool used to scratch or mark hard surfaces

1. Calibrated
2. Scribe
3. Rafter and brace table
4. Joinery
5. Miter
6. Miter box
7. Molding

2. List the basic rules concerning the safe use of hand tools.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

3. List basic rules concerning the care of hand tools.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

4. List ten basic carpentry tools.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

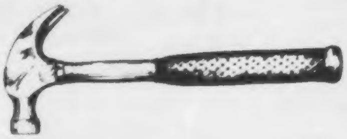
g. ____________________

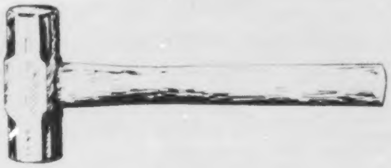
h. ____________________

i. ____________________

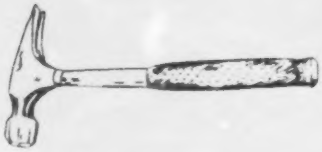
j. ____________________

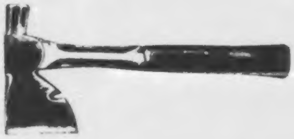
5. Identify the types of hammers used in carpentry by writing the correct names in the blanks provided.





a. ____________________ b. ____________________





c. ____________________ d. ____________________

6. Match the carpentry hammers on the right to their uses. Place the appropriate numbers in the blanks provided. A blank may have more than one correct answer.

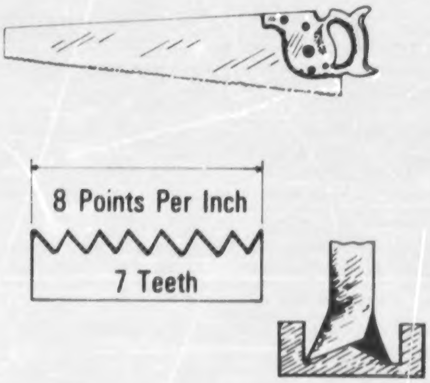
______a. Driving and drawing nails

______b. Driving stakes

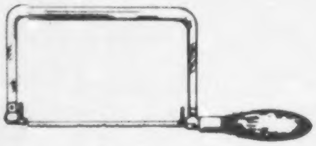
______c. Sharpening stakes, trimming framing members, and nailing

1. Straight claw hammer
2. Sledge hammer
3. Half hatchet
4. Curved claw hammer

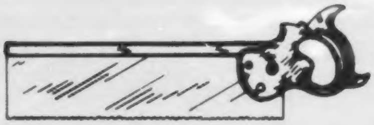
7. Identify the following types of handsaws used by carpenters by writing the correct names in the blanks provided.

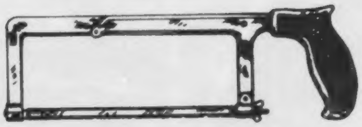


a. ______________________________

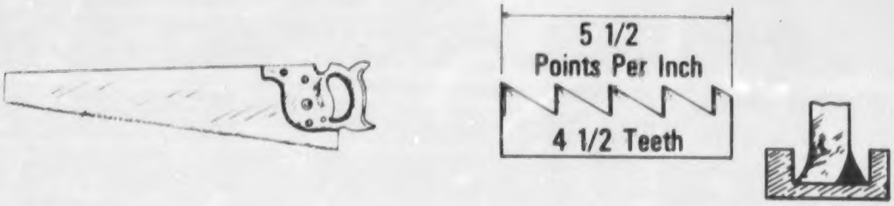


b. ______________________________ c. ______________________________





d. ______________________ e. ______________________



f. ______________________

8. Match the types of handsaws on the right to their uses.

_____a. Cuts across the grain of wood

_____b. Cuts with the grain of wood

_____c. Makes fine cuts for joinery; is used in a miter box

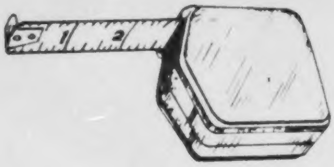
_____d. Cuts curves; shapes ends of molding for joints and for scroll work

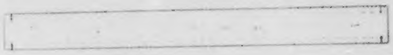
_____e. Cuts gentle curves and inside corners

_____f. Cuts all types of metal

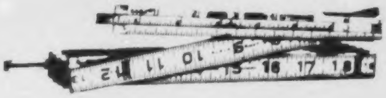
1. Compass saw (keyhole saw)
2. Back saw (miter box saw)
3. Crosscut saw
4. Rip saw
5. Coping saw
6. Hacksaw

9. Identify the types of measuring instruments below.





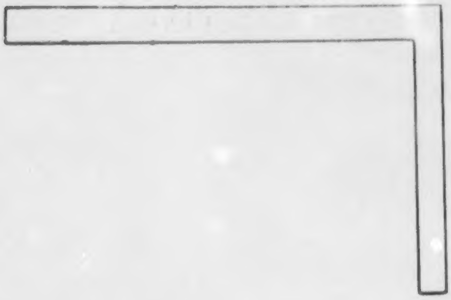
a. ____________________ b. ____________________

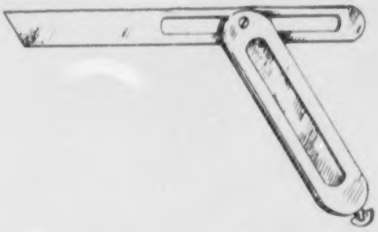


21
11
10
9
15
16
17
18

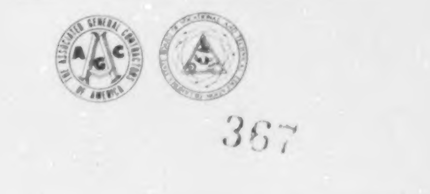
c. ____________________

10. Identify the types of squares below.





a. ____________________ b. ____________________



c. ____________________

11. Match the types of squares on the right to their uses.

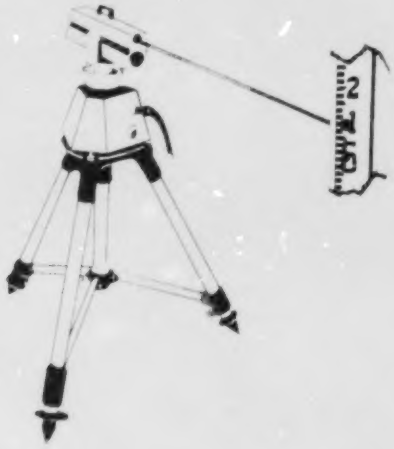
______a. General framing procedures for layout of walls, partitions, rafters, braces, and stairs

______b. General purpose squaring; 45° miter marking instrument

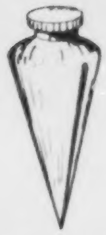
______c. Measure or transfer angles from 0° to 180°; check a miter cut

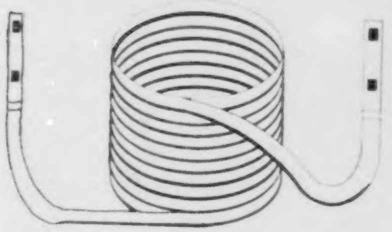
1. Sliding T bevel
2. Framing square (rafter square)
3. Combination square

12. Identify types of leveling and plumbing instruments.

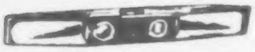


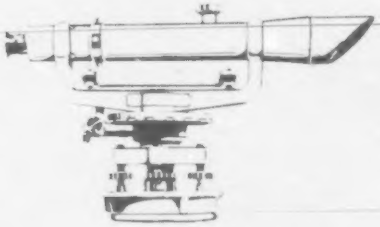
a. ______________________________



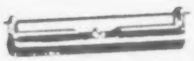


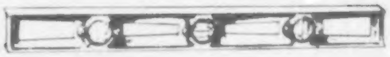
b. ______________________________ c. ______________________________





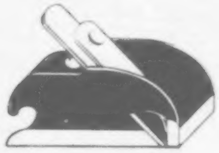
d. ______________________________ e. ______________________________

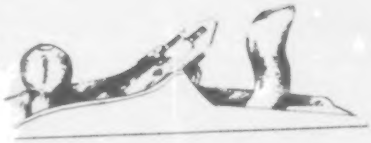




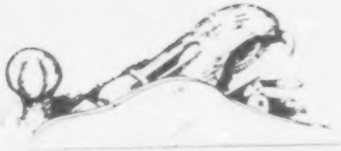
f. ______________________________ g. ______________________________

13. Identify the following types of wood planes.





a. ______________________________ b. ______________________________



c. ____________________

14. Match the types of wood planes on the right to their uses.

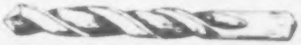
______a. General purposes — 1. Block plane

______b. Small jobs, such as trim and end grain — 2. Jack plane

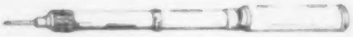
______c. Corners and hard-to-get-to places — 3. Rabbet plane

15. Identify the types of boring and drilling tools below.

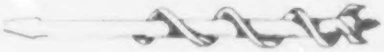
a. ____________________



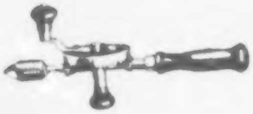
b. ____________________



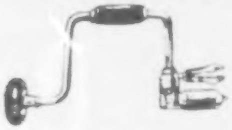
c. ____________________



d. ____________________



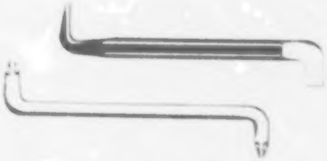
e. ____________________



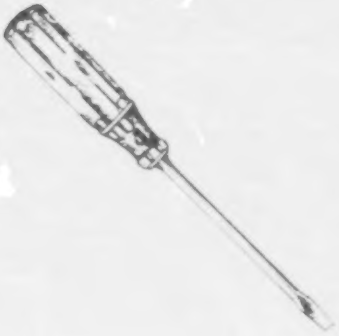
f. ____________________

16. Identify the following types of screwdrivers.

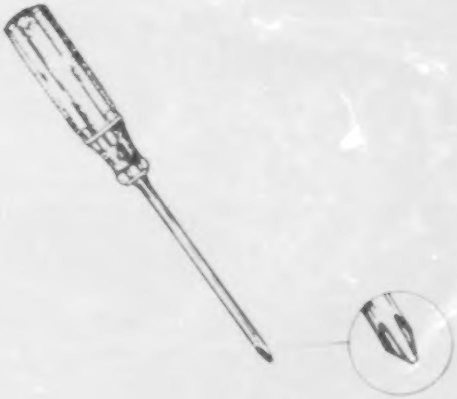
a. ____________________



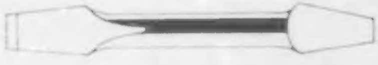
b. ____________________



c. ______________________

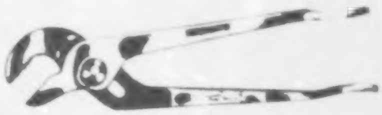


d. ______________________

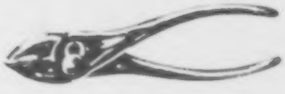


e. ______________________

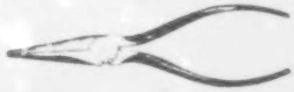
17. Identify types of pliers used by carpenters.



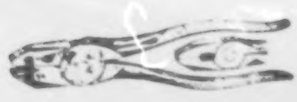
a. ______________________



b. ______________________

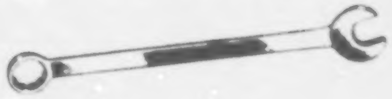


c. ______________________

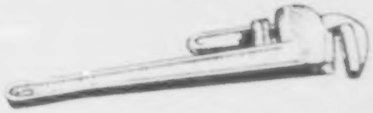


d. ______________________

18. Identify the following types of wrenches.



a. ______________________

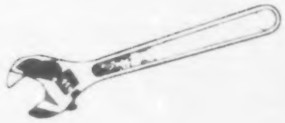


b. ______________________

c. ______________________________

d. ______________________________

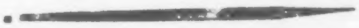
e. ______________________________



f. ______________________________

19. Identify the following types of files.

a. ______________________________



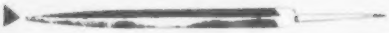
b. ______________________________

c. ______________________________

d. ______________________________

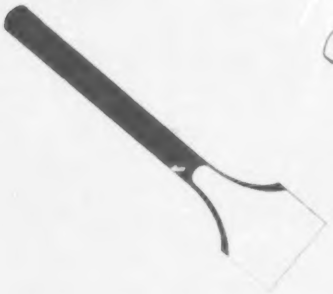
e. ______________________________

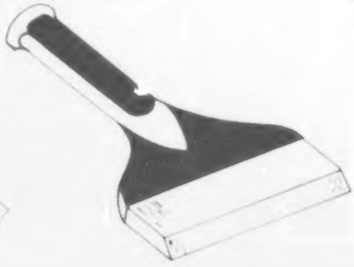
f. ______________________________

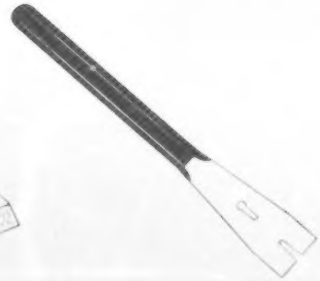


g. ______________________ h. ______________________

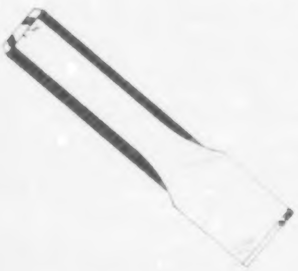
20. Identify the types of chisels below.

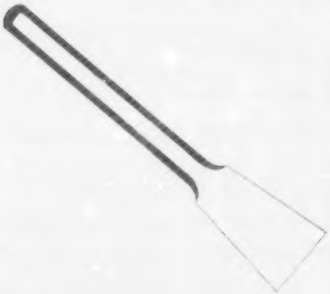


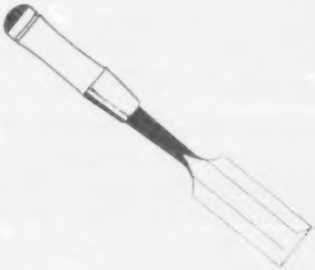




a. ______________________ b. ______________________ c. ______________________

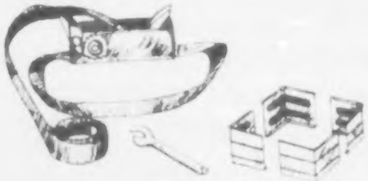


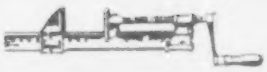




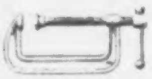
d. ______________________ e. ______________________ f. ______________________

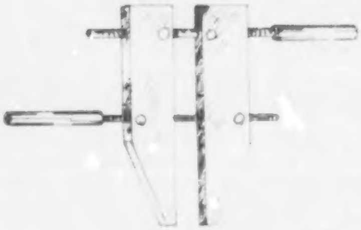
21. Identify the following types of clamps.

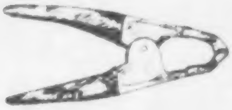




a. ______________________ b. ______________________

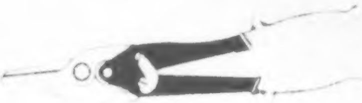


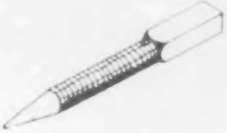




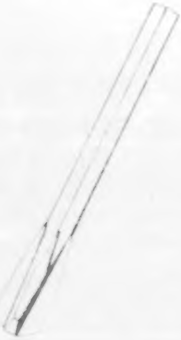
c. ______________ d. ______________ e. ______________

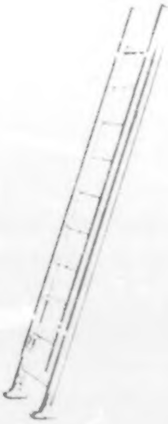
22. Identify the following miscellaneous tools used by carpenters.



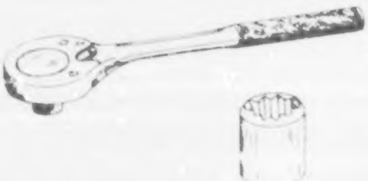


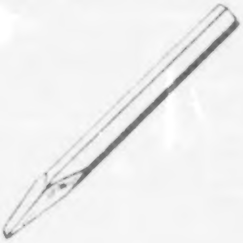
a. ______________ b. ______________



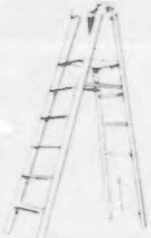


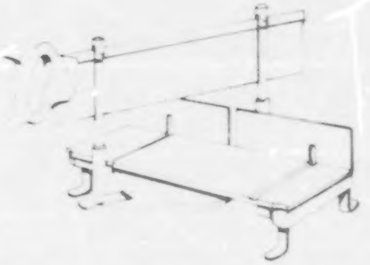
c. ______________ d. ______________





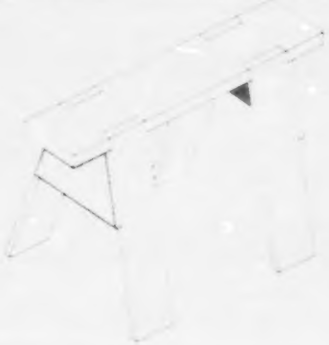
e. ______________ f. ______________

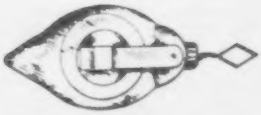




g. ______________________

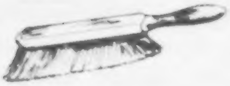
h. ______________________

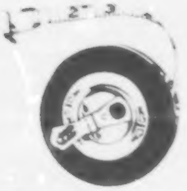




i. ______________________

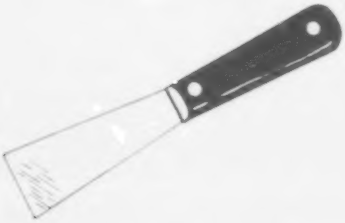
j. ______________________

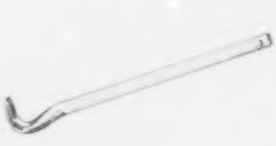




k. ______________________

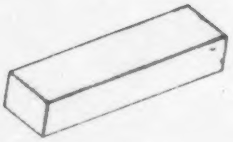
l. ______________________

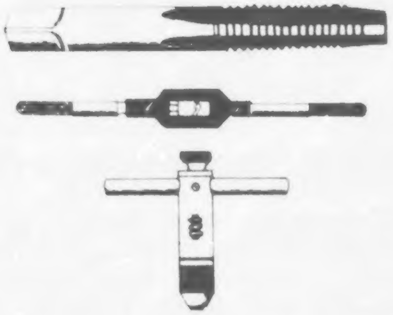




m. ______________________

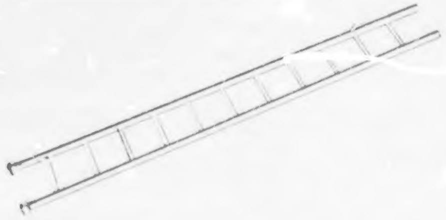
n. ______________________

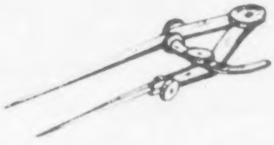




o. ______________________

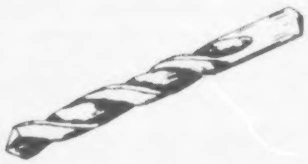
p. ______________________

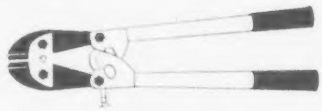




q. ______________________

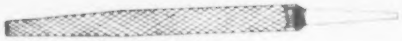
r. ______________________

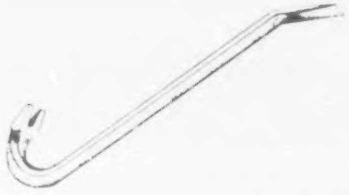




s. ______________________

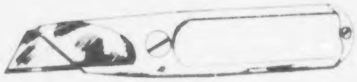
t. ______________________

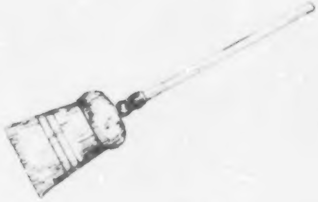




u. ______________________

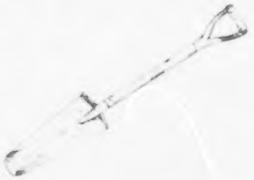
v. ______________________

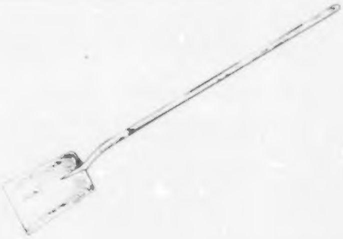




w. ____________________

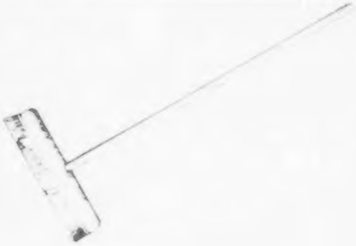
x. ____________________

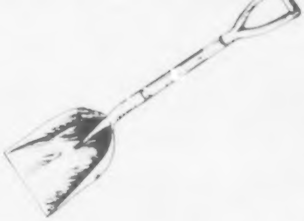




y. ____________________

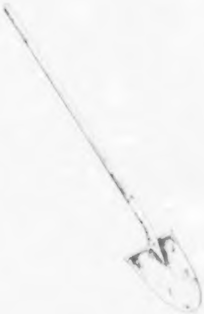
z. ____________________





aa. ____________________

bb. ____________________



cc. ____________________

HAND TOOLS
UNIT I

ANSWERS TO TEST

1. a. 4
   b. 6
   c. 7
   d. 1
   e. 3
   f. 5
   g. 2
2. a. Use the correct tool for the job
   b. Do not use dull or broken tools
   c. Do not throw tools
   d. Keep fingers away from edges of cutting tools and work away from your body
   e. Be sure that tool handles are in good condition and are securely fastened to body of tool
3. a. Keep hand tools sharp
   b. Protect the cutting edge of tools when not in use
   c. Keep tools dry and lightly oiled when not in use
   d. Use tools only for the purposes for which they were intended
4. Any ten of the following:
   a. Hammer
   b. Handsaw
   c. Rule
   d. Square
   e. Level
   f. Plane
   g. Brace and bit
   h. Screwdriver
   i. Pliers
   j. Adjustable wrench
   k. File
   l. Chisel
   m. Knife

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5. a. Claw hammer (curved claw)
   b. Sledge hammer
   c. Claw hammer (straight claw)
   d. Half hatchet
6. a. 1, 4
   b. 2
   c. 3
7. a. Crosscut saw
   b. Coping saw
   c. Compass saw (keyhole saw)
   d. Back saw (miter box saw)
   e. Hacksaw
   f. Rip saw
8. a. 3
   b. 4
   c. 2
   d. 5
   e. 1
   f. 6
9. a. Steel tape
   b. Bench rule
   c. Folding rule
10. a. Framing square (rafter square)
    b. Sliding T bevel
    c. Combination square
11. a. 2
    b. 3
    c. 1

12. a. Laser beam level
    b. Plumb bob
    c. Water level
    d. Torpedo level
    e. Builder's level
    f. Line level
    g. Spirit level
13. a. Rabbet plane
    b. Jack plane
    c. Block plane
14. a. 2
    b. 1
    c. 3
15. a. Flat bit (speed bit)
    b. Twist drill
    c. Push drill
    d. Auger bit
    e. Hand drill
    f. Carpenter's brace
16. a. Automatic
    b. Offset with common and phillips bits
    c. Common (flat blade)
    d. Phillips
    e. Bit for carpenter's brace
17. a. Channel-lock
    b. Combination slip-joint
    c. Needle nose
    d. Side cutting

18. a. Combination
    b. Pipe
    c. Hex key (Allen wrench)
    d. Open-end
    e. Box-end
    f. Adjustable
19. a. Cant saw
    b. Square
    c. Slitting
    d. Flat
    e. Round
    f. Half round
    g. Triangular (three square)
    h. Knife
20. a. Stripping
    b. Brick
    c. Ripping
    d. Cold
    e. Floor (straight blade)
    f. Wood
21. a. Band (strap)
    b. Bar
    c. C
    d. Hand screw
    e. Spring
22. a. Tin snips
    b. Nail set
    c. Star drill

d. Extension ladder (nonskid)

e. Ratchet wrench and socket

f. Point

g. Step ladder

h. Miter box and saw

i. Saw buck (saw horse)

j. Chalk line and reel

k. Bench brush

l. 100' tape

m. Putty knife

n. Nail claw

o. Carbide sharpening stone

p. Taps and tap wrenches

q. Single ladder (nonskid)

r. Dividers

s. Drill bit

t. Bolt cutters

u. Wood rasp

v. Pry bar (crow bar)

w. Utility knife

x. Hand broom

y. Sharp shooter

z. Long handled square point shovel

aa. Push broom

bb. Sand scoop

cc. Long handled round point shovel

POWER TOOLS
UNIT I[illegible]

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the common power tools and accessories. The student should be able to match the power tools to their correct operations or jobs and list basic rules concerning the safe use and care of power tools. This knowledge will be evidenced by completion of the unit test with 100 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Identify power tools used by carpenters.
2. Match power tools to the correct operations or jobs.
3. List general rules concerning the safe use of power tools.
4. List basic rules concerning the care of power tools.
5. List safety rules for specific power tools.
6. Identify the accessories used with power tools.

POWER TOOLS
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information sheet.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Have students demonstrate the ability to use each tool safely and according to the recommended use.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Power Tools

      2. TM 2--Power Tools (Continued)

      3. TM 3--Power Tools (Continued)

      4. TM 4--Power Tools (Continued)

      5. TM 5--Power Tool Accessories

   D. Test

   E. Answers to test

II. Unit references:

   A. Feirer, John L. *Woodworking for Industry*. Peoria, Illinois: Charles A. Bennett Company, Inc., 1971.

   B. Groneman, Chris H., and Galzener, Everett R. *Technical Woodworking.* St. Louis, Missouri: McGraw-Hill Book Company, 1966.

C. Hjorth, Herman, and Holtrop, William F. *Operation of Modern Woodworking Machines*. New York: The Bruce Publishing Company, 1966.

D. Wagner, Willis H. *Modern Carpentry*. Homewood, Illinois: Goodheart-Willcox, 1969.

POWER TOOLS
UNIT II

INFORMATION SHEET

I. Power tools used by carpenters (Transparencies I-4)

- A. Table saw
- B. Electric handsaw
- C. Jig saw
- D. Electric miter saw
- E. Electric drill, 1/4"
- F. Electric drill, 1/2"
- G. Belt sander
- H. Radial arm saw
- I. Router
- J. Jointer
- K. Power plane
- L. Hammer drill
- M. Portable rotary hammer
- N. Spindle shaper
- O. Powder actuated tool
- P. Power screwdriver
- Q. Bench grinder
- R. Band saw
- S. Surfacer
- T. Reciprocating saw
- U. Power nailer

INFORMATION SHEET

II. Basic operations of power tools

- A. Table saw
    1. Ripping
    2. Cross cutting
    3. Mitering
    4. Rabbeting
    5. Dadoing
- B. Electric handsaw
    1. Cross cutting
    2. Ripping
    3. Mitering
    4. Beveling
- C. Jig saw
    1. Cutting curved or irregular lines
    2. Cross cutting
    3. Ripping
- D. Reciprocating saw
    1. Cutting curved or irregular lines
    2. Cross cutting
    3. Ripping
    4. Internal cutting
- E. Electric miter saw
    1. Cross cutting
    2. Mitering
- F. Electric drill, 1/4" and 1/2"
    1. Drilling and boring
    2. Driving screws

INFORMATION SHEET

G. Belt sander
   1. Face sanding
   2. Edge sanding

H. Radial arm saw
   1. Ripping
   2. Cross cutting
   3. Mitering
   4. Rabbeting
   5. Dadoing
   6. Compound mitering

I. Router
   1. Edge shaping
   2. Rabbeting
   3. Grooving, fluting, and reeding
   4. Trimming laminates

J. Jointer
   1. Edge planing
   2. Rabbeting
   3. Chamfering
   4. Beveling
   5. Tapering
   6. Face planing

K. Power plane
   1. Face planing
   2. Edge planing
   3. Chamfering
   4. Beveling

INFORMATION SHEET

L. Hammer drill

   1. Drilling holes in masonry or concrete
   2. Setting anchors

M. Portable rotary hammer

   1. Drilling in concrete
   2. Chipping concrete

N. Spindle shaper

   1. Edge shaping
   2. Shaping molding
   3. Grooving, fluting, and reeding

O. Powder actuated tool

   (CAUTION: Operator must be certified and carry a safety certification card.)

   1. Driving studs into concrete or steel
   2. Fastening wood to concrete or steel
   3. Fastening steel to steel
   4. Fastening steel to concrete

P. Power screwdriver

   1. Driving screws in metal studs
   2. Fastening sheetrock to studs

Q. Bench grinder

   1. Grinding rough places off steel
   2. Sharpening tools

R. Band saw--Sawing curved lines and circles

S. Surfacer

   1. Face planing
   2. Planing to uniform thickness

T. Power nailer--Driving nails

INFORMATION SHEET

III. General rules concerning safe use of power tools

A. Do not attempt to operate tools before getting instructions

B. Always wear safety goggles when operating or working around power tools

C. Lift and carry heavy and/or bulky objects safely

D. Do not jostle persons operating power tools

E. Do not look around or attempt to carry on a conversation while operating a power tool

F. Wear appropriate clothing for the job

G. Make sure all tools are properly grounded before using

H. Do not leave tools running unattended

I. Keep feet and fingers away from blades and other moving parts when tools are in operation

J. Make sure all tools are turned off or disconnected before performing maintenance

K. Assume a safe and comfortable position before using power tools

L. Use power tools only for their intended uses

M. Do not use dull or broken tools

N. Do not throw waste material in the work area

IV. Basic rules concerning the care of power tools

A. Keep tools clean and in good working order

B. Follow manufacturer's maintenance procedures

C. Do not mistreat power tools

D. Keep tools in their proper places when not in use

E. Do not operate tools with dull accessories, such as blades or bits

V. Safety rules for specific power tools

A. Table saw

1. Keep guard down over saw while machine is being used

2. Do not stand directly in line with the blade

INFORMATION SHEET

3. Make sure saw does not project more than 1/8" above the stock being cut
4. Never reach across the saw blade
5. Secure help to support stock when ripping long stock

   (NOTE: The weight of the stock may cause the table to lean.)
6. Make all adjustments on the machine with the power off and blade stopped
7. Use the push stick for all ripping of less than four inches
8. Do not cut stock to length using the miter gauge and rip fence without first clamping on a step block for clearance
9. DO NOT rip without the rip fence or cross cut without the miter gauge
10. Be sure the tilted saw will clear before turning on machine when cutting angles
11. Always get a straight edge on the stock before ripping
12. Do not rip cylindrical stock on a circular saw
13. Take extra care to hold a board when using a dado or molding head
14. Do not use saw with dull, cracked, or wrong kind of blade

B. Electric handsaw

1. Be familiar with the correct operations and adjustments of the saw before attempting to use it
2. Allow saw to gain maximum speed before starting the cut
3. Be sure the automatic guard is free and retractable

   (CAUTION: Do not lock guard in the retracted position.)
4. Keep a firm grip on the saw at all times
5. Keep electric cord in the clear to avoid cutting it
6. Check stock for nails and screws before cutting
7. Set blade only deep enough to cut through the material

INFORMATION SHEET

   8. Lay the saw down on its side after finishing the cut
   9. Use electric cords of sufficient size to service saw
   10. Do not stand in water while using the saw
   11. Check safety ground and be sure it is fastened to the saw

C. Jig and reciprocating saws

   1. Keep fingers away from blade
   2. Turn off motor immdiately after finishing the cut
   3. Disconnect cord or turn off master switch before replacing a blade or making adjustments
   4. Make sure your hands and feet are dry before using these saws
   5. Be sure tool is properly grounded

D. Electric miter saw

   1. Disconnect power before making adjustments or changing blade
   2. Keep blade sharp
   3. Do not attempt to cut stock that is too thick or too wide
   4. Secure a helper to hold the end of long stock
   5. Keep guards in place at all times
   6. Use miter saw only for its intended use

E. Electric hand drill, hammer drill, and rotary hammer

   1. Never use a tool that is not properly grounded
   2. Never attempt to use a hand auger bit; use only drills and bits designed for the tool
   3. Wear safety goggles
   4. Never try to stop the tool by taking hold of the chuck after the power is off
   5. Back out often to clean out the hole on deep cuts
   6. Always remove the chuck key before turning on the power

INFORMATION SHEET

F. Belt sander

1. Keep power cord away from belt of sander
2. Hold sander firmly with both hands
3. Do not wear loose fitting clothes while sanding
4. Be sure sander has stopped running before turning it loose
5. Keep fingers away from revolving belt

G. Radial arm saw

1. Make sure saw has attained maximum speed before starting the cut
2. Do not let the saw feed too fast when cross cutting heavy stock

   (NOTE: The saw will have a tendency to feed itself.)
3. Make sure the saw is set at the proper depth before turning on the machine
4. Stand to the side of the line of sawing operation when ripping
5. Do not feed or pull stock too fast when ripping as this will jam the saw
6. Use only a sharp and properly set blade
7. Use the proper blade for the job to be done
8. Always use the anti-kickback guard when ripping
9. Do not stop blade by forcing scrap stock into blade
10. Follow the same safety rules set up for the table saw when ripping on the radial saw
11. Feed the material against the direction of the blade rotation when ripping on the radial saw

H. Router and power plane

1. Make all adjustments on the router and/or planer with the plug pulled
2. Keep both hands in their proper location on the router and/or planer
3. Keep a firm grip on the tool being used
4. Always use a door jack when routing for hinges or planing edges of a door; never have another person hold the door for you

INFORMATION SHEET

5. Wear safety goggles when routing and/or planing

6. Always use jigs and guides with the router; never route or plow freehand

7. Do not attempt to remove too much material with one cut

I. Jointer

1. Keep a guard over knives at all times while operating jointer

2. Adjust depth of cut before power is turned on

3. Do not use jointer for stock less than twelve inches long

4. Use push stick or push block when jointing narrow or flat pieces of stock

5. Do not use jointer for strips less than one-inch wide

6. Screw clamping screws securely on fence so that the fence will not slip while in use

7. Do not start the cut until the machine has come up to maximum speed

8. Keep fingers as high as possible on the stock and never drag thumb at back of board

9. Avoid taking cuts deeper than 1/8"; too deep a cut sometimes causes kickbacks

10. Change position of hands so they will never be directly over the knives when passing work over jointer

11. Follow through with stock and allow guard to return to closed position

12. Do not attempt to plane discs or other pieces that cannot be held securely against fence

13. Keep your eyes on your work; do not look around or talk while using the jointer

J. Spindle shaper

1. Whenever possible, install the cutter so the bottom of the stock is shaped; in this way, the stock will cover most of the cutter and act as a guard

2. Make sure the cutter is locked securely to the spindle

3. Always position the left fence so that it will support the work that has passed the cutters

INFORMATION SHEET

4. Adjust the spindle for correct height and lock in position; rotate the spindle by hand to make sure it clears all guards or fences

5. Check the direction of rotation by snapping the switch on and off; watch as the cutters come to rest; ALWAYS FEED AGAINST THE CUTTING EDGE

   (NOTE: Some shapers have a reversing switch so that the spindle can be rotated either clockwise or counter-clockwise.)

6. Examine the stock carefully for defects before cutting; never cut through a loose knot or through stock that is cracked or split

7. Hold the stock down and against the fence with hands on top of the material, yet out of range of the cutters

8. Use all guards, jigs, and clamping devices whenever possible

9. Always use a depth collar when shaping irregular work; put a guide pin in the table to start the cutting

10. Do not set spring hold-down clips too tightly against the work; use just enough tension to hold the work against the fence

11. Swing work into cutters when depth collars and a guide pin are used for contour work

    (NOTE: It is a good idea to keep the stock in motion in the direction of feed.)

12. Never shape a piece shorter than ten inches

K. Powder actuated tool

   1. Take training program available from tool manufacturer; do not use powder actuated tool unless certified

   2. Use the proper size pin and load

   3. Never hold the end of the barrel against any part of the body

   4. Do not hold hand on back of material in line with barrel

   5. Wear safety goggles

   6. Do not shoot close to edge of concrete

L. Power screwdriver

   1. Never place screw point against your body

   2. Never hold hand back of screw when driving in light metal

INFORMATION SHEET

M. Band saw

1. Never saw with guards removed
2. Use proper size blade to avoid breaking

N. Surfacer

1. Become familiar with the stop switch, elevating hand wheel, and brake (if any) so that the machine can be stopped quickly
2. Check the wood for defects, such as large knots, that might cause the board to split under pressure
3. Never surface painted or varnished stock; in fact, used lumber of any kind should not be surfaced
4. Make sure that the board to be surfaced has one true face
5. Be sure that shortest board run through the machine is two inches longer than the distance between the infeed and outfeed rolls
6. Always stand to one side of table, never directly in line with stock
7. Try to determine grain direction and feed into machine so that cutting will be done with grain
8. Allow machine to do work as feed rolls take hold of stock; take hands off board
9. Lower the bed and turn off the machine if board gets stuck in machine
10. Never stoop down to watch a board being surfaced
11. Be especially careful of your fingers when surfacing a short board; sometimes the infeed rolls will tip the board up and then down quickly so that fingers get pinched between table top and stock
12. If stock is long, get help to feed stock and to take it off as it leaves machine

O. Power nailer

1. Use only nails or fasteners that were designed for the gun
2. Do not discharge nailer except when actually nailing
3. Keep hands and body away from the discharge area of nailer

INFORMATION SHEET

P. Bench grinder

   1. Wear safety goggles

   2. Keep guards in place at all times

   3. Keep fingers away from grinding wheels

VI. Accessories used with power tools (Transparency 5)

A. Drive pin

B. Threaded stud

C. Percussion carbide-tipped drill

D. Concrete chisel

E. Bull point

F. Masonry drill

G. Tamper

H. Saw blades

   1. Miter saw

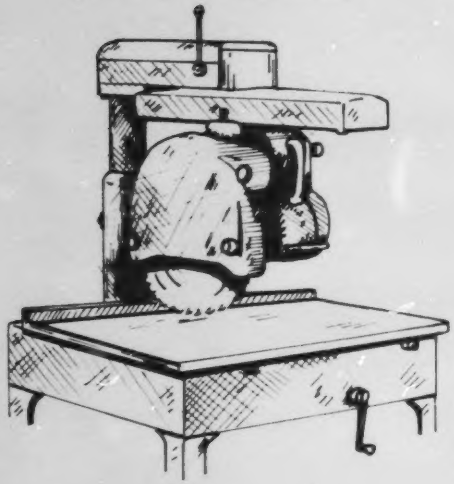
   2. Chisel-toothed combination

   3. Rip

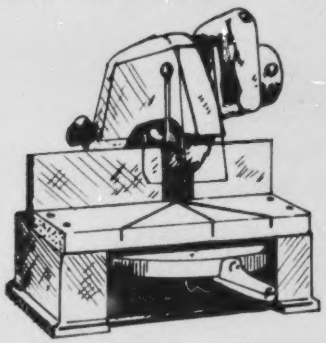
   4. Cross cut

Power Tools

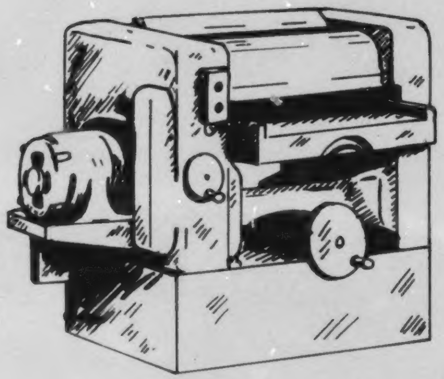
Radial Arm Saw



Electric Miter Saw



Surfacer



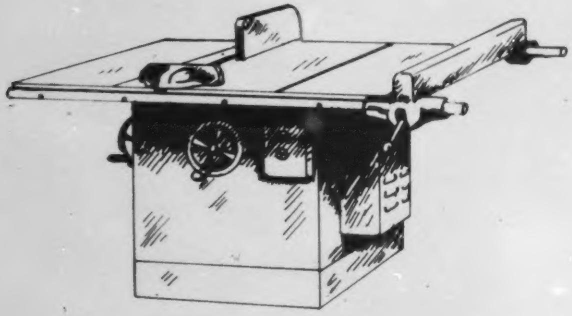
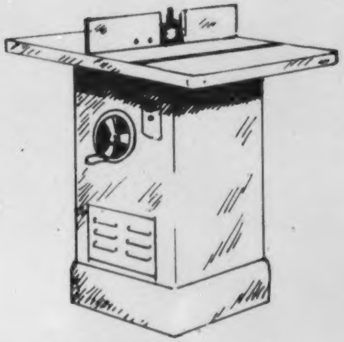
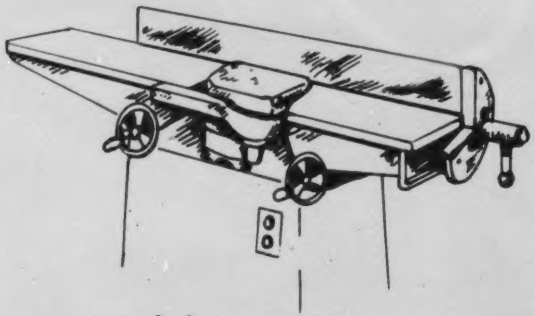


Table Saw



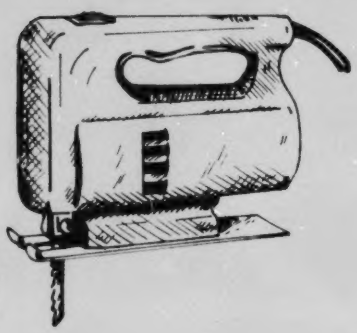
Spindle Shaper



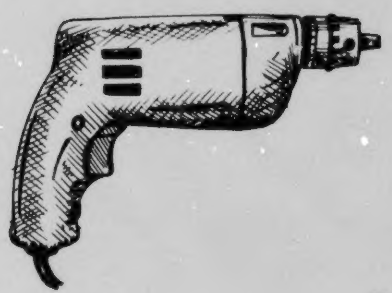
Jointer

Power Tools
(Continued)

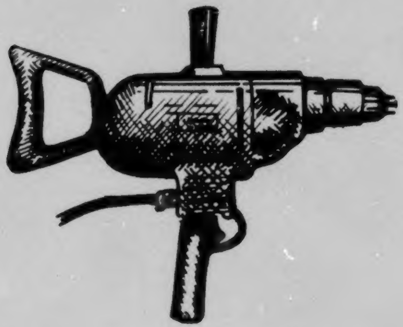
Jig Saw



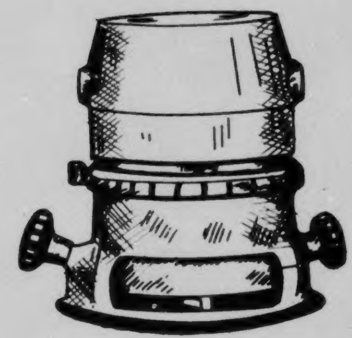
¼″ Electric Drill



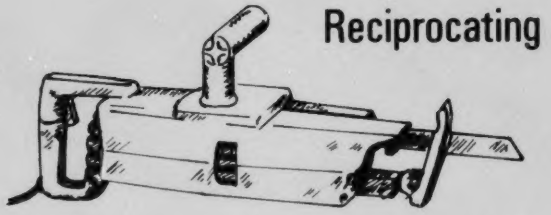
½″ Electric Drill



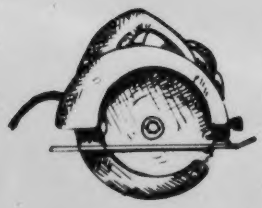
Router

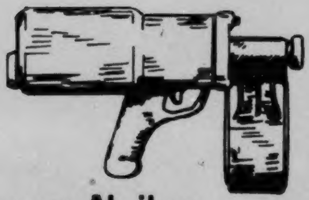


Reciprocating Saw



Electric Handsaw



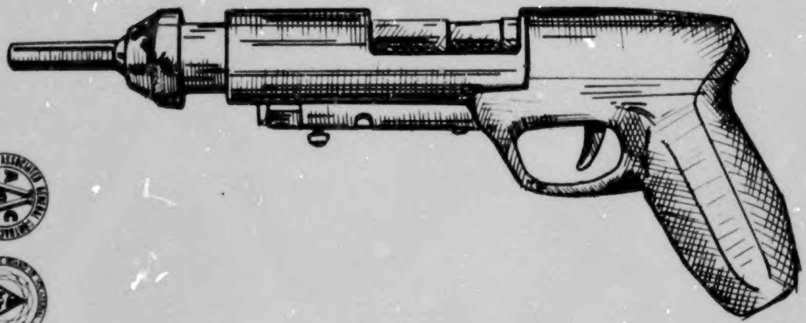


Power Nailer

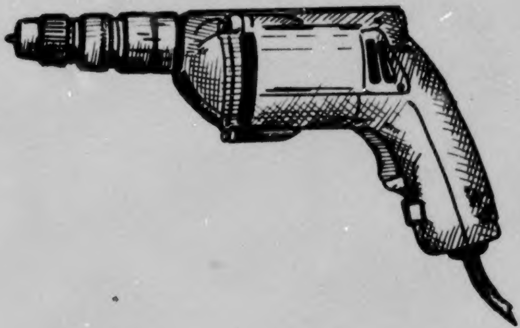
Power Tools

(Continued)

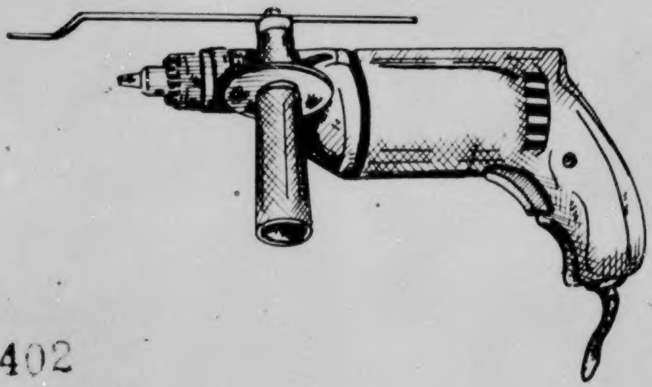
Powder Actuated Tool



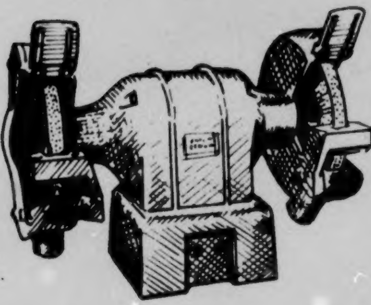
Power Screwdriver



Hammer Drill



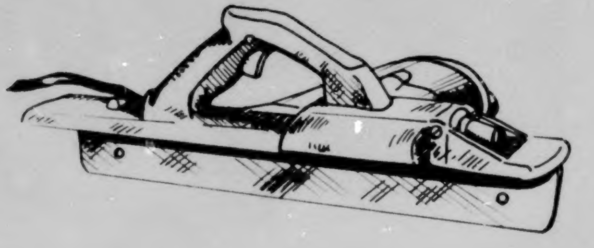
Bench Grinder



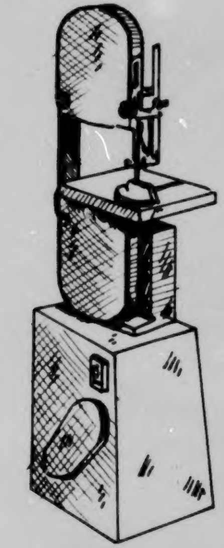
Power Tools

(Continued)

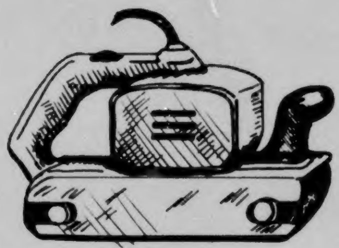
Power Plane



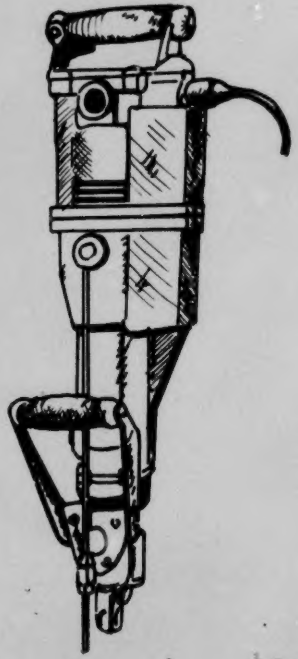
Band Saw



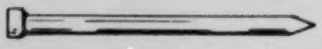
Belt Sander

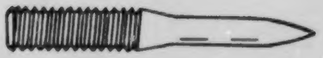


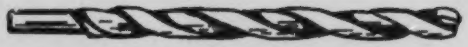
Portable Rotary Hammer

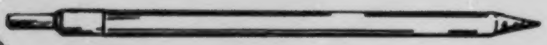


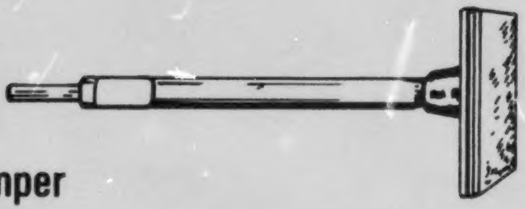
Power Tool Accessories

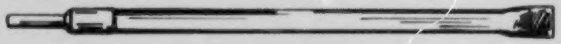

Drive Pin

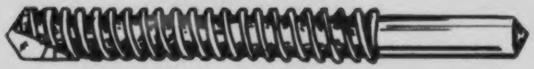

Threaded Stud


Percussion Carbide-Tipped Drill

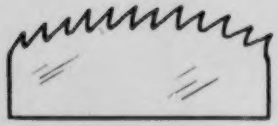

Bull Point

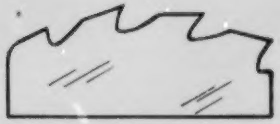

Tamper

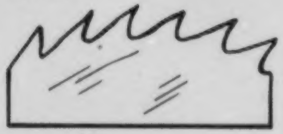

Concrete Chisel

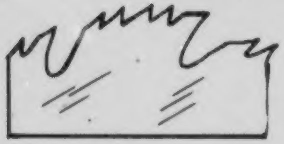

Masonry Drill

SAW BLADES


Cross Cut


Chisel-Toothed Combination


Rip


Miter

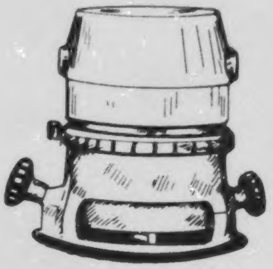
POWER TOOLS
UNIT II

TEST

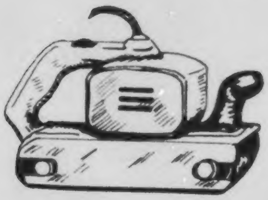
NAME ______________________________ SCORE ______________

1. Identify the following power tools used by carpenters by writing the correct names in the blanks provided.

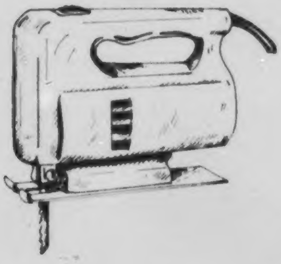
a. ____________________



b. ____________________



c. ____________________



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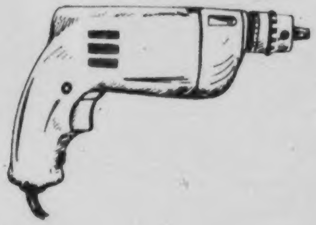
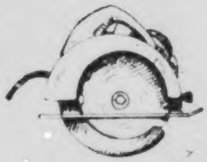


e. ______________________



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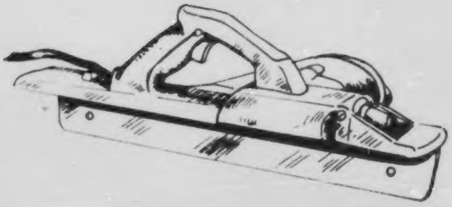

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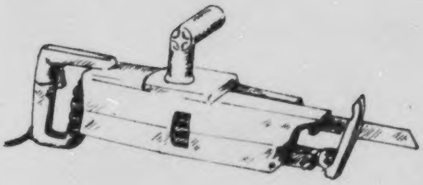
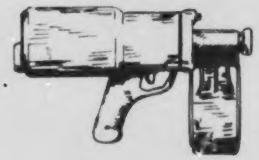
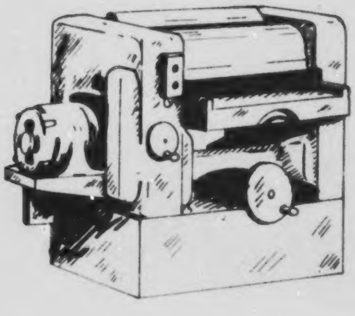


h. ______________________



i. ______________________



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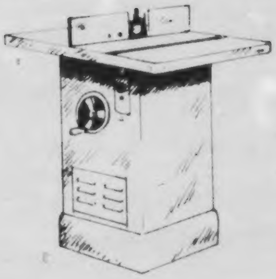
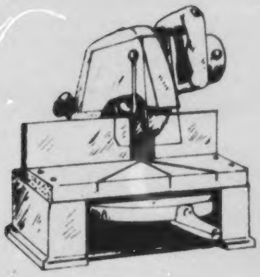
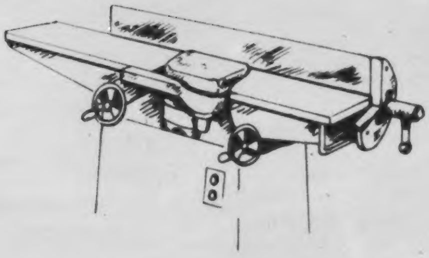


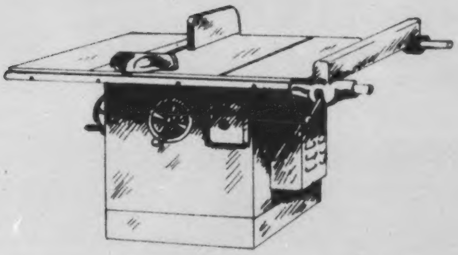
k. ____________________

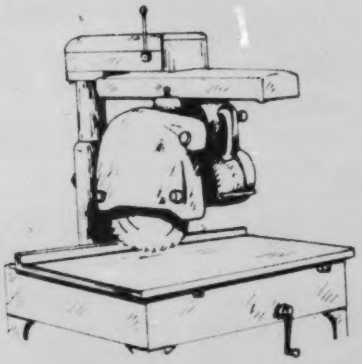


l. ____________________

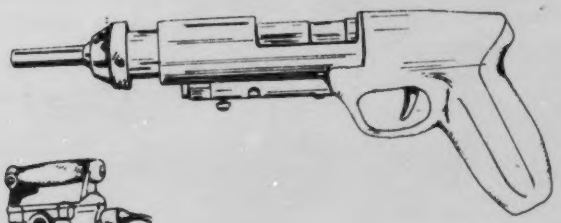


m. ____________________

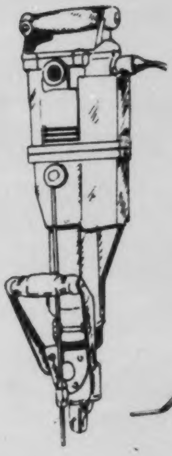




n. ____________________



o. ____________________



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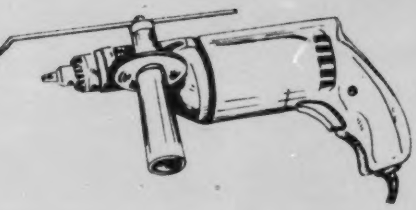

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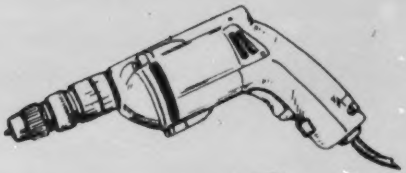

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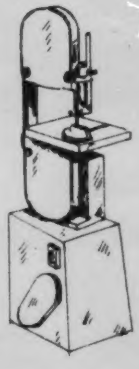
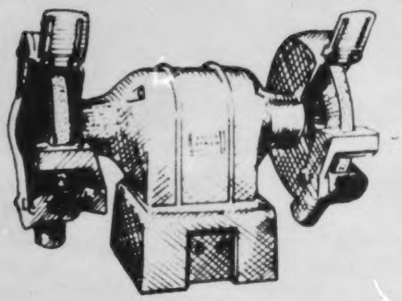
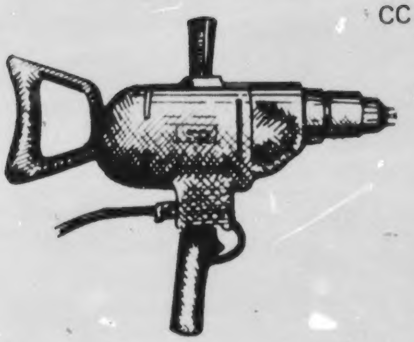


s. ____________________



t. ______________________



u. ______________________

2. Match the power tools on the right to the correct operations or jobs. Place the appropriate numbers in the blanks provided. A blank may have more than one correct answer.

______a. Ripping, cross cutting, mitering, rabbeting, dadoing, compound mitering

______b. Ripping, cross cutting, mitering, rabbeting, dadoing

______c. Cross cutting, ripping, mitering, beveling

______d. Cutting curved or irregular lines, cross cutting, ripping, internal cutting

______e. Edge planning, rabbeting, chamfering, beveling, tapering, face planing

______f. Face planing, edge planing, chamfering, beveling

______g. Face planing, planing to uniform thickness

______h. Cross cutting, mitering

______i. Edge shaping; shaping, molding; grooving, fluting, and reeding

______j. Edge shaping; rabbeting; grooving, fluting, and reeding; trimming laminates

______k. Drilling and boring, driving screws

______l. Driving nails

______m. Sawing curved lines and circles

______n. Face sanding, edge sanding

______o. Drilling holes in masonry or concrete, setting anchors

______p. Cutting curved or irregular lines, cross cutting, ripping

1. Table saw
2. Electric handsaw
3. Jig saw
4. Electric miter saw
5. Electric drill, 1/4"
6. Electric drill, 1/2"
7. Belt sander
8. Radial arm saw
9. Router
10. Jointer
11. Power plane
12. Hammer drill
13. Portable rotary hammer
14. Spindle shaper
15. Powder actuated tool
16. Power screwdriver
17. Bench grinder
18. Band saw
19. Surfacer
20. Reciprocating saw
21. Power nailer

______q. Driving studs into concrete or steel, fastening wood to concrete or steel, fastening steel to steel, fastening steel to concrete

______r. Grinding rough places off steel, sharpening tools

______s. Driving screws in metal studs, fastening sheetrock to studs

______t. Drilling in concrete, chipping concrete

3. List seven general rules concerning the safe use of power tools.

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

   f. ____

   g. ____

4. List three basic rules concerning the care of power tools.

   a. ____

   b. ____

   c. ____

5. List two safety rules for each of the specific power tools below.

   a. Table saw

      1) ____

      2) ____

   b. Electric handsaw

      1) ____

      2) ____

c. Jig and reciprocating saws

1) ____________________

2) ____________________

d. Electric miter saw

1) ____________________

2) ____________________

e. Electric hand drill, hammer drill, and rotary hammer

1) ____________________

2) ____________________

f. Belt sander

1) ____________________

2) ____________________

g. Radial arm saw

1) ____________________

2) ____________________

h. Router and power plane

1) ____________________

2) ____________________

i. Jointer

1) ____________________

2) ____________________

j. Spindle shaper

1) ____________________

2) ____________________

k. Powder actuated tool

1) ____________________

2) ____________________

l. Power screwdriver

1) ______________________________

2) ______________________________

m. Band saw

1) ______________________________

2) ______________________________

n. Surfacer

1) ______________________________

2) ______________________________

o. Power nailer

1) ______________________________

2) ______________________________

p. Bench grinder

1) ______________________________

2) ______________________________

6. Identify the following accessories used with power tools by writing the correct names in the blanks provided.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

f. ______________________

g. ______________________

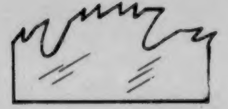
h. ______________________

i. ______________________

j. ______________________

k. ______________________

a.



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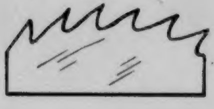

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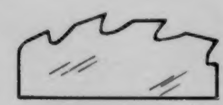

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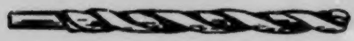

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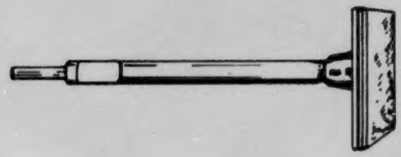

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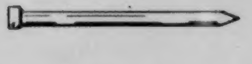

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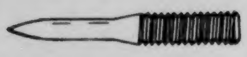

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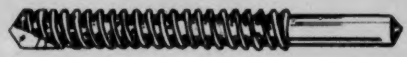
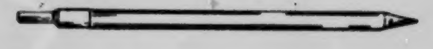
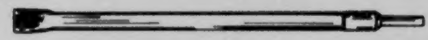


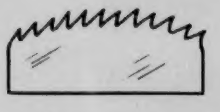
i.



j.



k.



POWER TOOLS
UNIT II

ANSWERS TO TEST

1. a. Router

   b. Belt sander

   c. Jig saw

   d. Electric drill, 1/4"

   e. Electric handsaw

   f. Power plane

   g. Reciprocating saw

   h. Power nailer

   i. Surfacer

   j. Spindle shaper

   k. Electric miter saw

   l. Jointer

   m. Table saw

   n. Radial arm saw

   o. Powder actuated tool

   p. Portable rotary hammer

   q. Hammer drill

   r. Power screwdriver

   s. Band saw

   t. Bench grinder

   u. Electric drill, 1/2"

2. a. 8
   b. 1
   c. 2
   d. 20
   e. 10
   f. 11
   g. 19
   h. 4
   i. 14
   j. 9
   k. 5, 6
   l. 21
   m. 18
   n. 7
   o. 12
   p. 3
   q. 15
   r. 17
   s. 16
   t. 13

3. Any seven of the following:

   a. Do not attempt to operate tools before getting instructions

   b. Always wear safety goggles when operating or working around power tools

   c. Lift and carry heavy and/or bulky objects safely

   d. Do not jostle persons operating power tools

   e. Do not look around or attempt to carry on a conversation while operating a power tool

   f. Wear appropriate clothing for the job

   g. Make sure all tools are properly grounded before using

   h. Do not leave tools running unattended

   i. Keep feet and fingers away from blades and other moving parts when tools are in operation

   j. Make sure all tools are turned off or disconnected before performing maintenance

   k. Assume a safe and comfortable position before using power tools

   l. Use power tools only for their intended uses

   m. Do not use dull or broken tools

   n. Do not throw waste material in the work area

4. Any three of the following:

    a. Keep tools clean and in good working order

    b. Follow manufacturer's maintenance procedures

    c. Do not mistreat power tools

    d. Keep tools in their proper places when not in use

    e. Do not operate tools with dull accessories, such as blades or bits

5. Any two of the following rules under each tool:

    a. Table saw

        1) Keep guard down over saw while machine is being used

        2) Do not stand directly in line with the blade

        3) Make sure saw does not project more than 1/8" above the stock being cut

        4) Never reach across the saw blade

        5) Secure help to support stock when ripping long stock

        6) Make all adjustments on the machine with the power off and blade stopped

        7) Use the push stick for all ripping of less than four inches

        8) Do not cut stock to length using the miter gauge and rip fence without first clamping on a step block for clearance

        9) DO NOT rip without the rip fence or cross cut without the miter gauge

        10) Be sure the tilted saw will clear before turning on machine when cutting angles

        11) Always get a straight edge on the stock before ripping

        12) Do not rip cylindrical stock on a circular saw

        13) Take extra care to hold a board when using a dado or molding head

        14) Do not use saw with dull, cracked, or wrong kind of blade

    b. Electric handsaw

        1) Be familiar with the correct operations and adjustments of the saw before attempting to use it

        2) Allow saw to gain maximum speed before starting the cut

        3) Be sure the automatic guard is free and retractable

4) Keep a firm grip on the saw at all times

5) Keep electric cord in the clear to avoid cutting it

6) Check stock for nails and screws before cutting

7) Set blade only deep enough to cut through the material

8) Lay the saw down on its side after finishing the cut

9) Use electric cords of sufficient size to service saw

10) Do not stand in water while using the saw

11) Check safety ground and be sure it is fastened to the saw

c. Jig and reciprocating saws

1) Keep fingers away from blade

2) Turn off motor immediately after finishing the cut

3) Disconnect cord or turn off master switch before replacing a blade or making adjustments

4) Make sure your hands and feet are dry before using these saws

5) Be sure tool is properly grounded

d. Electric miter saw

1) Disconnect power before making adjustments or changing blade

2) Keep blade sharp

3) Do not attempt to cut stock that is too thick or too wide

4) Secure a helper to hold the end of long stock

5) Keep guards in place at all times

6) Use miter saw only for its intended use

e. Electric hand drill, hammer drill, and rotary hammer

1) Never use a tool that is not properly grounded

2) Never attempt to use a hand auger bit; use only drills and bits designed for the tool

3) Wear safety goggles

4) Never try to stop the tool by taking hold of the chuck after the power is off

5) Back out often to clean out the hole on deep cuts

6) Always remove the chuck key before turning on the power

f. Belt sander

1) Keep power cord away from belt of sander

2) Hold sander firmly with both hands

3) Do not wear loose fitting clothes while sanding

4) Be sure sander has stopped running before turning it loose

5) Keep fingers away from revolving belt

g. Radial arm saw

1) Make sure saw has attained maximum speed before starting the cut

2) Do not let the saw feed too fast when cross cutting heavy stock

3) Make sure the saw is set at the proper depth before turning on the machine

4) Stand to the side of the line of sawing operation when ripping

5) Do not feed or pull stock too fast when ripping as this will jam the saw

6) Use only a sharp and properly set blade

7) Use the proper blade for the job to be done

8) Always use the anti-kickback guard when ripping

9) Do not stop blade by forcing scrap stock into blade

10) Follow the same safety rules set up for the table saw when ripping on the radial saw

11) Feed the material against the direction of the blade rotation when ripping on the radial saw

h. Router and power plane

1) Make all adjustments on the router and/or planer with the plug pulled

2) Keep both hands in their proper location on the router and/or planer

3) Keep a firm grip on the tool being used

4) Always use a door jack when routing for hinges or planing edges of a door; never have another person hold the door for you

5) Wear safety goggles when routing and/or planing

6) Always use jigs and guides with the router; never route or plane freehand

7) Do not attempt to remove too much material with one cut

i. Jointer

1) Keep a guard over knives at all times while operating jointer

2) Adjust depth of cut before power is turned on

3) Do not use jointer for stock less than twelve inches long

4) Use push stick or push block when jointing narrow or flat pieces of stock

5) Do not use jointer for strips less than one-inch wide

6) Screw clamping screws securely on fence so that fence will not slip while in use

7) Do not start the cut until the machine has come up to maximum speed

8) Keep fingers as high as possible on the stock and never drag thumb at back of board

9) Avoid taking cuts deeper than 1/8"; too deep a cut sometimes causes kickbacks

10) Change position of hands so they will never be directly over the knives when passing work over jointer

11) Follow through with stock and allow guard to return to closed position

12) Do not attempt to plane discs or other pieces that cannot be held securely against fence

13) Keep your eyes on your work; do not look around or talk while using the jointer

j. Spindle shaper

1) Whenever possible, install the cutter so the bottom of the stock is shaped; in this way, the stock will cover most of the cutter and act as a guard

2) Make sure the cutter is locked securely to the spindle

3) Always position the left fence so that it will support the work that has passed the cutters

4) Adjust the spindle for correct height and lock in position; rotate the spindle by hand to make sure it clears all guards or fences

5) Check the direction of rotation by snapping the switch on and off; watch as the cutters come to rest; ALWAYS FEED AGAINST THE CUTTING EDGE

6) Examine the stock carefully for defects before cutting; never cut through a loose knot or through stock that is cracked or split

7) Hold the stock down and against the fence with hands on top of the material, yet out of range of the cutters

8) Use all guards, jigs, and clamping devices whenever possible

9) Always use a depth collar when shaping irregular work; put a guide pin in the table to start the cutting

10) Do not set spring hold-down clips too tightly against the work; use just enough tension to hold the work against the fence

11) Swing work into cutters when depth collars and a guide pin are used for contour work

12) Never shape a piece shorter than ten inches

k. Powder actuated tool

1) Take training program available from tool manufacturer; do not use powder actuated tool unless certified

2) Use the proper size pin and load

3) Never hold the end of the barrel against any part of the body

4) Do not hold hand on back of material in line with barrel

5) Wear safety goggles

6) Do not shoot close to edge of concrete

l. Power screwdriver

1) Never place screw point against your body

2) Never hold hand back of screw when driving in light metal

m. Band saw

1) Never saw with guards removed

2) Use proper size blade to avoid breaking

n. Surfacer

1) Become familiar with the stop switch, elevating hand wheel, and brake (if any) so that the machine can be stopped quickly

2) Check the wood for defects, such as large knots, that might cause the board to split under pressure

3) Never surface painted or varnished stock; in fact, used lumber of any kind should not be surfaced

4) Make sure that the board to be surfaced has one true face

5) Be sure that shortest board run through the machine is two inches longer than the distance between the infeed and outfeed rolls

6) Always stand to one side of table, never directly in line with stock

7) Try to determine grain direction and feed into machine so that cutting will be done with grain

8) Allow machine to do work as feed rolls take hold of stock; take hands off board

9) Lower the bed and turn off the machine if board gets stuck in machine

10) Never stoop down to watch a board being surfaced

11) Be especially careful of your fingers when surfacing a short board; sometimes the infeed rolls will tip the board up and then down quickly so that fingers get pinched between table top and stock

12) If stock is long, get help to feed stock and to take it off as it leaves machine

o. Power nailer

1) Use only nails or fasteners that were designed for the gun

2) Do not discharge nailer except when actually nailing

3) Keep hands and body away from the discharge area of nailer

p. Bench grinder

1) Wear safety goggles

2) Keep guards in place at all times

3) Keep fingers away from grinding wheels

6. a. Miter saw blade

b. Rip saw blade

c. Chisel-toothed combination saw blade

d. Percussion carbide-tipped drill

e. Tamper

f. Drive pin

g. Threaded stud

h. Masonry drill

i. Bull point

j. Concrete chisel

k. Cross cut saw blade

COMMERCIAL CARPENTRY

PROGRESS CHART

Section D
Tools

	UNIT I HAND TOOLS			UNIT II POWER TOOLS																
	1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Student's Name / **Job**	UNIT TEST			UNIT TEST	Electric Handsaw	Reciprocating Saw	Table Saw	Radial Arm Saw	Jointer	Surfacer	Router & Power Plane	Spindle Shaper	Portable Rotary Hammer & Hammer Drill	Bench Grinder	Belt Sander	Electric Miter Saw	Powder Actuated Tool & Power Nailer	Power Screwdriver and Electric Drills	Band Saw	Jig Saw
1																				
2																				
3																				
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	Accuracy	85% Correct		100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct	100% Correct

Section E

Blueprint Reading

BLUEPRINT READING
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the alphabet of lines and types of architectural drawings. The student should be able to read architect's and engineer's scales, list major items included in a set of specifications, and extract specific information from a set of specifications. This knowledge will be evidenced by completion of assignment sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with blueprint reading to the correct definitions.
2. Identify types of architectural drawings.
3. Classify types of architectural drawings by their characteristics.
4. Identify types of lines included in the alphabet of lines.
5. Match types of lines to their descriptions.
6. Match the names of floor plan symbols to pictures of the symbols.
7. Match the names of electrical symbols to the correct symbols.
8. Match the names of sectioning symbols to the correct symbols.
9. Match the names of mechanical symbols to the correct symbols.
10. Read an architect's scale.
11. Read an engineer's scale.
12. List major items that should be included in a set of specifications.
13. Extract specific information from a prepared set of building specifications.

BLUEPRINT READING
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

- A. Provide students with objective sheet.
- B. Provide students with information and assignment sheets.
- C. Make transparencies.
- D. Discuss unit and specific objectives.
- E. Discuss information and assignment sheets.
- F. Build a small scale model of a building to use in class.
- G. Use a set of actual drawings for instructions.
- H. Give test.

II. Instructional materials:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
    1. TM 1--Plot Plan
    2. TM 2--Foundation Plan
    3. TM 3--Floor Plan
    4. TM 4--Elevations
    5. TM 5--Details
    6. TM 6--Section Drawing
    7. TM 7--Section Drawing (Continued)
    8. TM 8--Alphabet of Lines
    9. TM 9--Alphabet of Lines (Continued)
    10. TM 10--Floor Plan Symbols
    11. TM 11--Electrical Symbols
    12. TM 12--Sectioning Symbols
    13. TM 13--Mechanical Symbols

14. TM 14--Architect's Scale

15. TM 15--Comparison of Solid Objects

16. TM 16--Engineer's Scale

17. TM 17--Engineer's Scale (Continued)

18. TM 18--Door Schedule

19. TM 19--Schedule of Hardware

D. Assignment sheets

1. Assignment Sheet #1--Read the Architect's Scale Using Full Scale or (12" = 1')

2. Assignment Sheet #2--Read the Architect's Scale Using Half Scale or (6" = 1')

3. Assignment Sheet #3--Read the Architect's Scale Using One-Fourth Scale or (3" = 1')

4. Assignment Sheet #4--Read the Architect's Scale Using One-Eighth Scale or (1 1/2" = 1')

5. Assignment Sheet #5--Read the Engineer's Scale Using Scale of 1" = 1'

6. Assignment Sheet #6--Read the Engineer's Scale Using Scale of 1" = 30'

7. Assignment Sheet #7--Read the Engineer's Scale Using Scale of 1" = 50'

E. Answers to assignment sheets

F. Test

G. Answers to test

III. Unit references:

A. French, Thomas E., and Vierch, Charles J. *Engineering Drawing.* New York: McGraw-Hill, 1966.

B. Hartman, William J. *Basic Drafting.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1972.

C. Helper, Donald E., and Wallach, Paul I. *Architectural Drafting and Design.* New York: McGraw-Hill, 1971

D. Hornung, William J. *Architectural Drafting.* Englewood, New Jersey: Prentice Hall, 1949.

BLUEPRINT READING
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Alphabet of lines--Set of conventional symbols covering all the lines needed to depict an object as to size and shape

B. Architect's scale--Rule divided into proportional feet and inches; a fraction of an inch is proportionally equal to one foot

Examples: 1/8", 1/4", 3/8", 1/2", 3/4", 1 1/2", and 3" to the foot

C. Architectural drawings--Graphic representations shown with lines and symbols

D. Structural drawing--Plans showing the structural components of the building

E. Mechanical drawing--Plans showing the plumbing and heating layout

F. Electrical drawing--Plans showing the electrical installation

G. Shop drawing--Plans showing detailed information of specific items

H. Blueprint--Copy of the original detailed drawing

I. Detail--Drawing that gives complete detailed information for an element of construction

J. Dimensions--Arrangement of lines and symbols to indicate the actual size for constructiong the object that is represented

K. Elevation--Drawings representing the front, sides, or rear face of a structure and usually made as though the observer were looking straight at it

L. Plan--In architecture, a diagram showing a horizontal view of a structure, such as floor plans and sectional plans

M. Scale drawing--Drawing made to a size either proportionally larger or smaller than the actual size of the object represented

N. Section--Drawing of an object that has been cut to show internal construction

O. Specifications--Detailed set of written instructions which explains the drawing, describes material and equipment used in the structure as to quality and types, and becomes part of the contract

P. Symbol--Arbitrary sign that has been standardized and is used to represent an object, quality, or method

INFORMATION SHEET

Q. Engineer's scale--Rule divided into decimals and/or tenths

Examples: 1" = 1', 10' = 1', or 100'= 1'

R. Bench mark (BM)--Metal or stone marker placed in the ground by a surveyor with the elevation indicated on it

(NOTE: This is the reference point for determining grades and elevations in the area.)

S. Datum point--Point with reference to which elevations are measured or indicated, such as a permanent bench mark

T. Change orders--Set of orders issued and signed by owner authorizing contractor to make a particular change

II. Types of architectural drawings (Transparencies 1, 2, 3, 4, and 5)

A. Plot plan

B. Foundation plan

C. Floor plan

D. Elevations

E. Details

III. Characteristics of architectural drawings (Transparencies 1-7)

A. Plot plan

1. Location of the structure on the site

2. Finished and existing grade contours

3. Property lines

4. Utilities

5. Location of existing conditions

(NOTE: This would include trees, buildings, or other structures.)

B. Foundation plan--Location and size of footings, grade beams, foundation walls, stem walls, and piers

INFORMATION SHEET

C. Floor plan

   1. Outside walls including the location and dimensions of all exterior openings
   2. Type of construction through the use of symbols
   3. Location of interior walls and partitions
   4. Location and swing of doors
   5. Stairways
   6. Location of cabinets and other built-ins

D. Elevation--Grade lines, floor heights, window sizes, roof lines, and/or other dimensions

(NOTE: Elevations and sections are very closely coordinated. Elevations are shown for all faces of the structure.)

E. Details

(NOTE: These drawings are primarily used to depict details of construction that are too small or not shown in sufficient detail on the plan or elevation drawings. They may be full size or to a larger scale than the plan, elevation, or sectional view.)

   1. Windows
   2. Mill work, trim, and specialty items
   3. Ornamental iron
   4. Doors (interior and exterior)
   5. Built-ins
   6. Door frames
   7. Stairs
   8. Walls and partitions

   (NOTE: Sections are used freely on these drawings.)

IV. Alphabet of lines (Transparencies 8 and 9)

A. Object line

B. Dimension line

C. Extension line

INFORMATION SHEET

D. Hidden line

E. Center line

F. Section line (cutting plane)

G. Break line, long

H. Break line, short

I. Phantom line

J. Leader

K. Fixture line

L. Section lining

V. Descriptions of types of lines (Transparencies 8 and 9)

A. Object lines--Show main outline of the structure, including exterior walls, interior partitions, porches, patios, and driveways

(NOTE: These lines should be the outstanding lines of the drawings.)

B. Dimension lines--Thin, unbroken lines which designate structure dimensions

C. Extension lines--Extend, but do not touch, the object lines; permit dimension lines to be drawn between them

D. Hidden lines--Short dashes used to show lines that are not visible from that view

E. Center lines--Series of short and long dashes used to designate centers and provide a reference point for dimensioning

F. Section lines (cutting plane)--Heavy lines consisting of a series of one long and two short dashes with arrows at each end pointing away from the area that is cut away for the purpose of sectioning; show the direction from which the section is supposed to be viewed (Transparencies 6 and 7)

G. Break lines, long--Used when an area cannot or should not be drawn entirely; a ruled line with freehand breaks

H. Break lines, short--Used when an area cannot or should not be drawn entirely; a wavy, uneven freeehand line

I. Phantom lines--Used to indicate alternate positions of moving parts, adjacent positions of related parts, and for repeated details

INFORMATION SHEET

J. Leaders--Used to connect a note or dimension to a part of the structure

K. Fixture lines--Outline the shape of equipment and furnishings

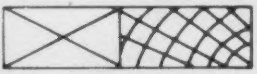
(NOTE: These lines are light to eliminate confusion with object lines.)

L. Section lining--Used to draw the section lining in sectional drawings; different material symbol is used for each structure material; lightly drawn line

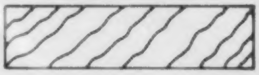
VI. Floor plan symbols (Transparency 10)

(NOTE: Check architect's drawings for symbols for particular jobs.)

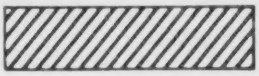
A. Wood (rough)



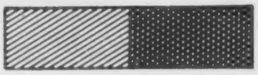
B. Wood (finished)



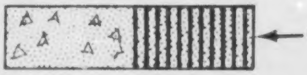
C. Brick



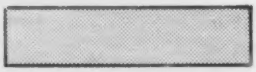
D. Firebrick



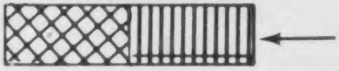
E. Concrete



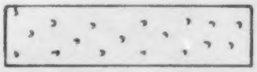
F. Sand, plaster, cement, gypsum board



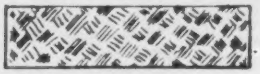
G. Tile--Hollow, terra cotta



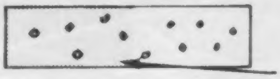
H. Cinders



I. Earth

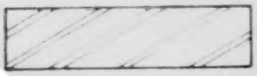


J. Gravel

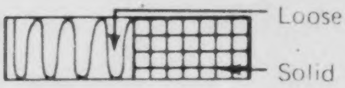


INFORMATION SHEET

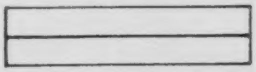
K. Structural steel or iron



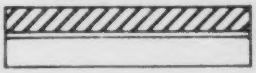
L. Insulation



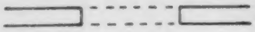
M. Flashing, termite barrier, waterproofing



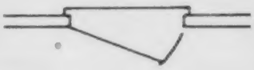
N. Brick veneer



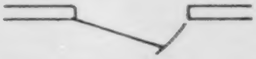
O. Arch--Cased opening



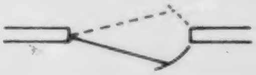
P. Outside door



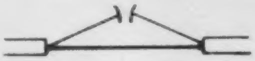
Q. Inside door



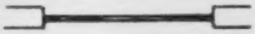
R. Double-acting door



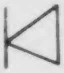
S. Casement window



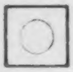
T. Double-hung window



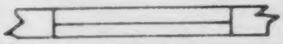
U. Telephone jack



V. Floor drain

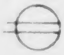


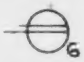
W. Glass (sheet and plate)



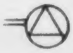
INFORMATION SHEET

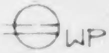
VII. Electrical symbols (Transparency 11)

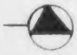
A. Duplex receptacle outlet 

B. Duplex grounding outlet 

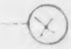
C. Ceiling lighting outlet

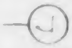
D. Duplex special-purpose receptacle outlet 

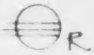
E. Weatherproof outlet 

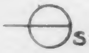
F. Special purpose outlet 

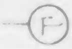
(NOTE: Use subscript letters to indicate functions, such as DW for dishwasher or DF for drinking fountain.)

G. Exit light outlet 

H. Junction box 

I. Range outlet 

J. Switch and single receptacle 

K. Fan outlet 

L. Single pole switch **S**

M. Double pole switch **S_2**

N. Three way switch **S_3**

O. Four way switch **S_4**

P. Switch and pilot lamp **S_P**

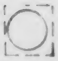
INFORMATION SHEET

Q. Weatherproof switch S_{WP}

R. Fused switch S_F

S. Thermostat Ⓣ

T. Ceiling lighting outlet for recessed fixture
(NOTE: The outline shows shape of fixture.)

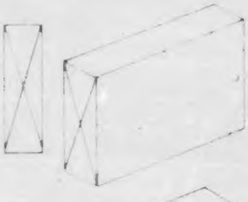


U. Lighting panel ▬

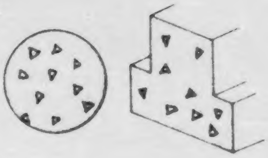
V. Power panel ▨

VIII. Sectioning symbols (Transparency 12)

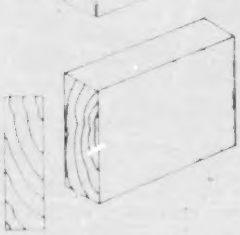
A. Rough lumber



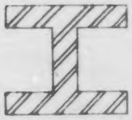
D. Concrete



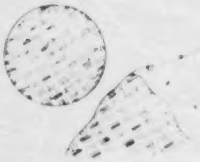
B. Finished lumber



E. Metal



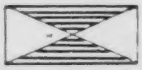
C. Earth



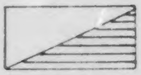
INFORMATION SHEET

IX. Mechanical symbols (Transparency 13)

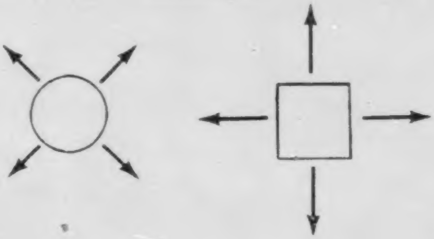
A. Supply duct section



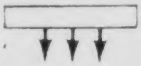
B. Exhaust, return, or outside air duct section



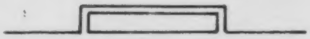
C. Supply outlet; ceiling diffuser



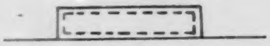
D. Linear diffuser



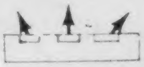
E. Recessed radiator



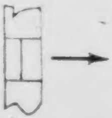
F. Enclosed radiator



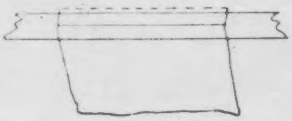
G. Unit heater



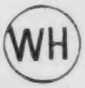
H. Louver opening



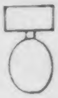
I. Intake louvers



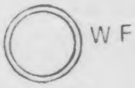
J. Water heater



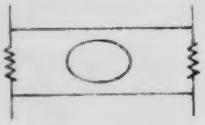
K. Water closet



L. Wash fountain



INFORMATION SHEET

M. Lavatory 

N. Cold water ———— – ———— – ————

O. Hot water ——— – – ——— – – ———

P. Fire line —— F —— F —— F

Q. Gas--Low pressure —— G —— G —— G

R. Vent – – – – – – – – – – –

X. Architect's scale (Transparencies 14 and 15, Assignment Sheets #1-#4)

A, Rules for reading a scale

1. Select proper scale ratio
2. Be sure scale is laying flat on the surface being measured
3. Double check all measurements
4. Practice measuring from the center of one line to the center of the next line
5. Do not use a scale where dimensions are available

B. Common scales to which plans are drawn

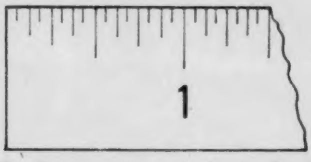
1. 12" = 1'-0" (full scale)
2. 6" = 1'-0" (one-half scale)
3. 3" = 1'-0 (one-fourth scale)
4. 1/2" = 1'-0"
5. 1/4" = 1'-0"
6. 1/8" = 1'-0"

INFORMATION SHEET

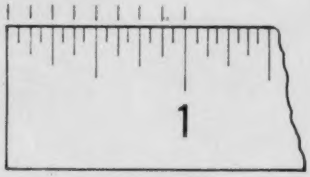
C. Interpreting graduations on the architect's scale

1. Full scale or 12" represents 1'

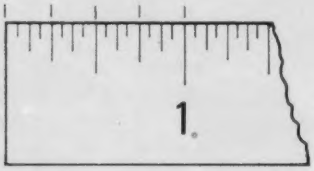
   a. 16 - 16ths make one inch



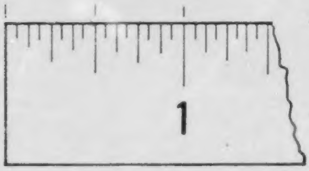
   b. 8 - 8ths make one inch; 2 - 1/16" make 1/8"



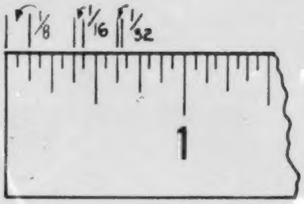
   c. 4 - 4ths make one inch; 4 - 1/16" make 1/4"



   d. 2 - 1/2ves make one inch; 8 - 1/16" make 1/2"



   e. For 1/32" increments there are two 1/32" in one 1/16" and two 1/16" in one 1/8"



   f. Dimensions are read in this order

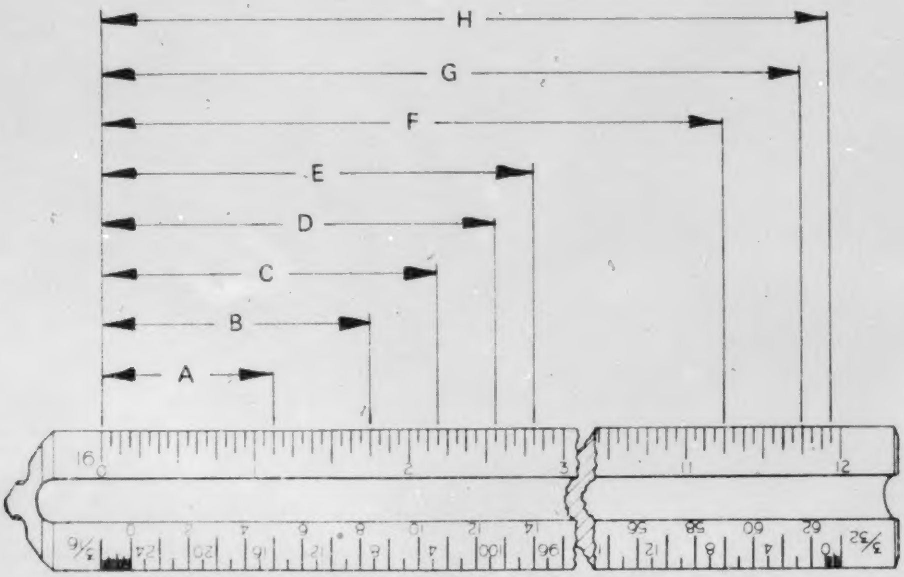
      1) Feet (')

      2) Inches (")

INFORMATION SHEET

3) Fractions of an inch

Example: Practice reading the following dimensions in inches and 1/16" (full scale)


H
G
F
E
D
C
B
A
16
0
1
2
3
11
12
3/16
3/32

A = 1" + 2/16" = 1 2/16" or 1 1/8"

B = 1" + 12/16" = 1 12/16" or 1 3/4"

C = 2" + 3/16" = 2 3/16"

D = 2" + 9/16 = 2 9/16"

E = 2" + 13/16" = 2 13/16"

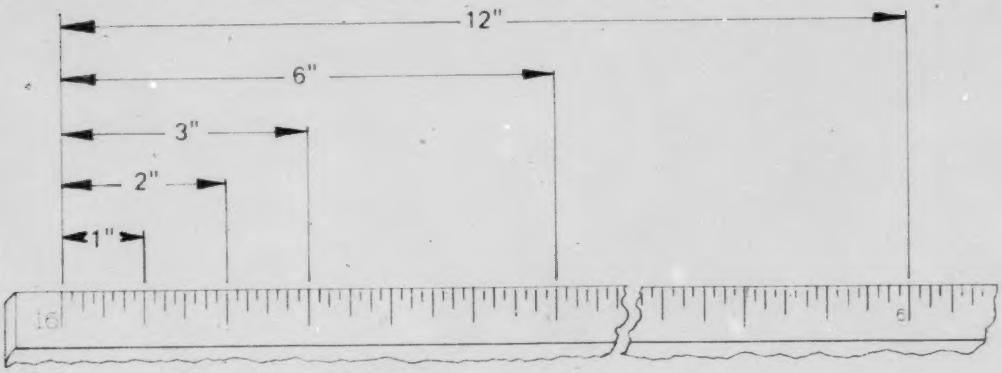
F = 11" + 4/16" = 11 4/16" or 11 1/4"

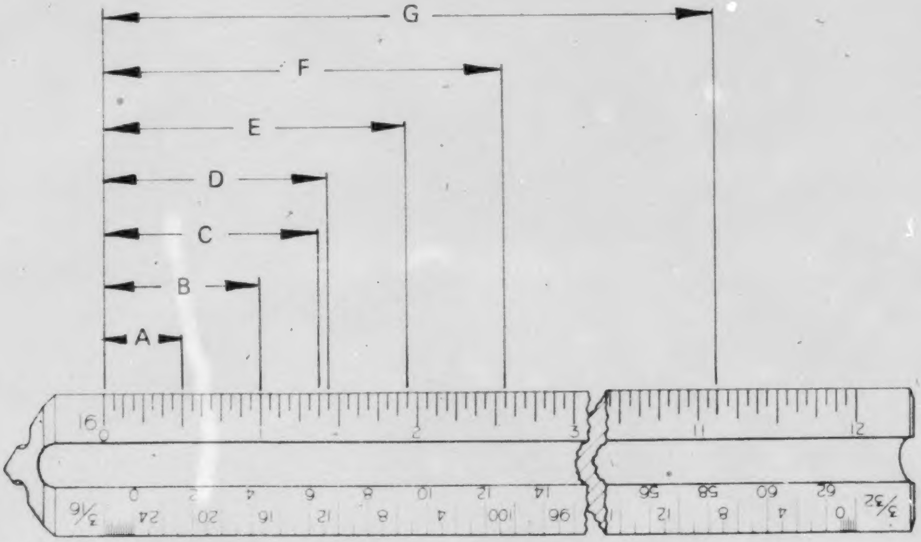
G = 11" + 12/16" = 11 12/16" or 11 3/4"

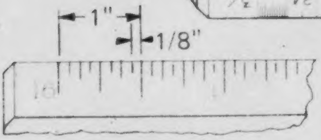
H = 11" + 15/16" = 11 15/16"

INFORMATION SHEET

2. One-half scale or 6" represents 12" or 1'-0"




G
F
E
D
C
B
A
16
0
1
2
3
11
12
3/16
3/32



At half scale the 1/16" graduations each represent 1/8"

A = 8/8" = 1"

B = 16/8" = 2"

C = 2" + 6/8" = 2 6/8" or 2 3/4"

D = 2" + 7/8" = 2 7/8"

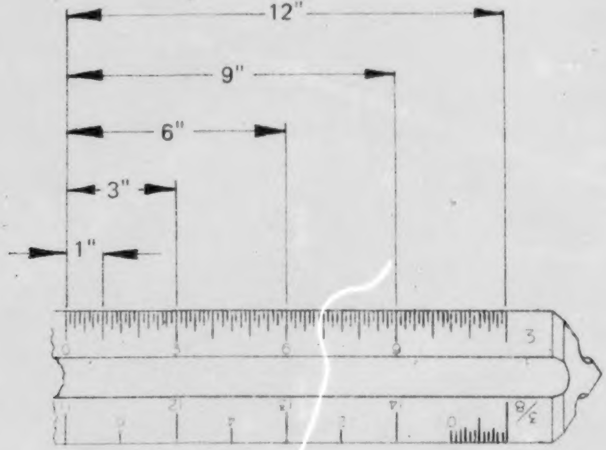
E = 3" + 7/8" = 3 7/8"

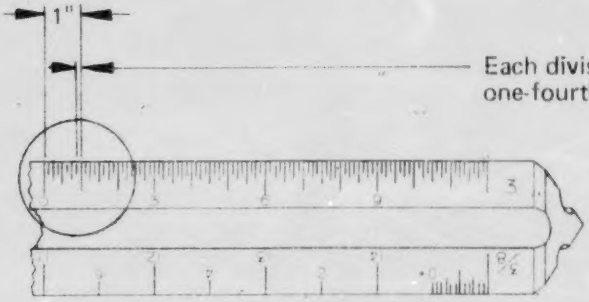
F = 5" + 1/8" = 5 1/8"

G = 22" + 2/8" = 22 2/8" or 22 1/4"

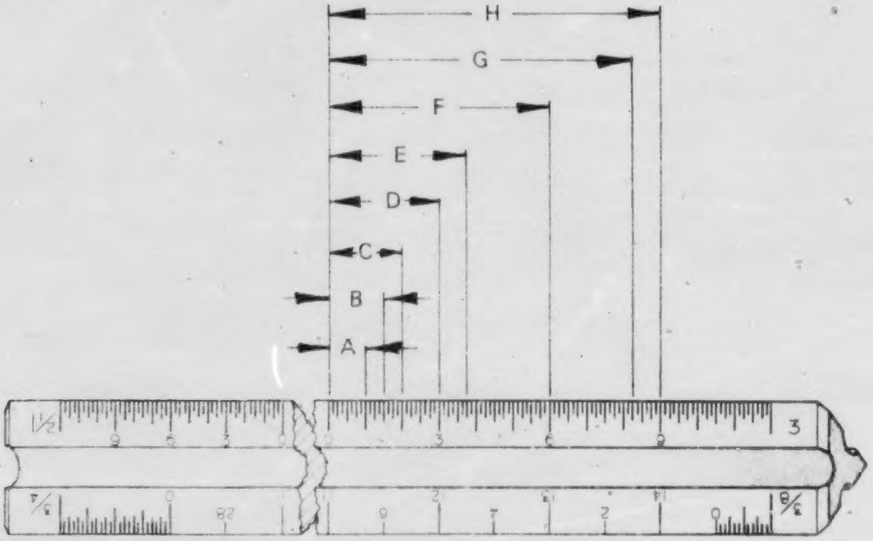
INFORMATION SHEET

3. One-fourth scale or 3" represents 12" or 1'-0"


12"
9"
6"
3"
1"
0
3
6
9
3
3/8



Each division equals 1/8" at one-fourth scale


H
G
F
E
D
C
B
A
1½
9
6
3
0
0
3
6
9
3
3/8

INFORMATION SHEET

A = 8 graduations = 1"

B = 1" + 4/8" = 1 4/8" or 1 1/2"

C = 1" + 8/8" = 1 8/8" or 2"

D = 3"

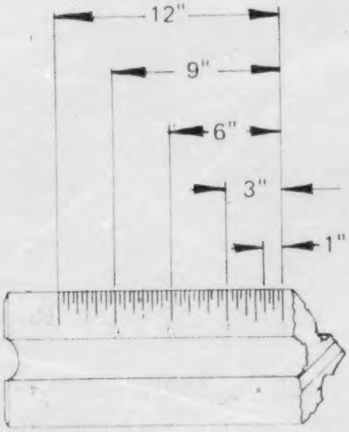
E = 3" + 6/8" = 3 6/8" or 3 3/4"

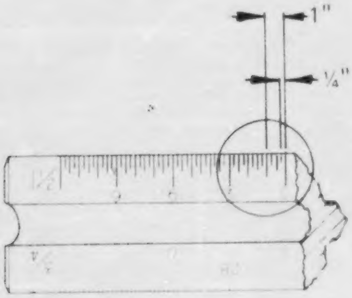
F = 6"

G = 8" + 2/8" = 8 2/8" or 8 1/4"

H = 9"

4. One-eighth scale or 1 1/2" represents 12" or 1'-0"

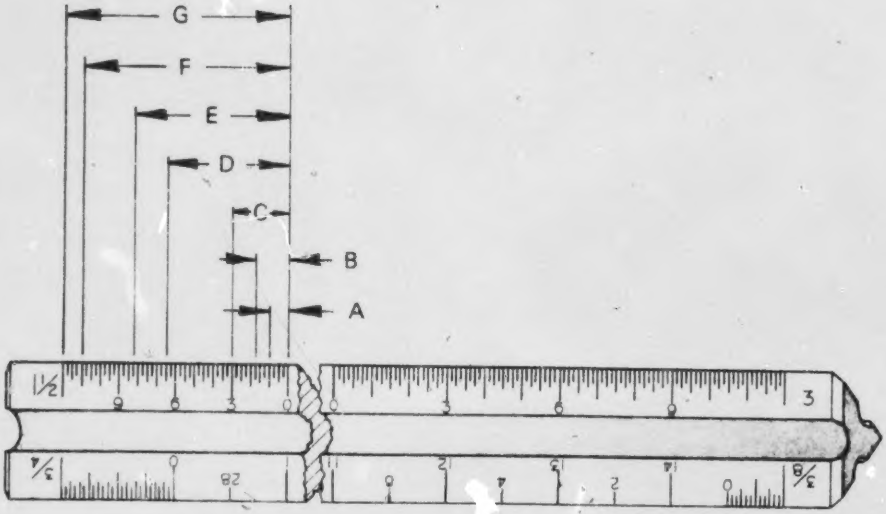




This is one inch at 1/8" scale graduated into spaces that represent 1/4"

THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA

INFORMATION SHEET


G
F
E
D
C
B
A
1½
9
6
3
0
0
3
6
9
3
¾
28
0
3/8

A = 4 graduations = 1"

B = 1" + 3/4" = 1 3/4"

C = 3"

D = 6" + 2/4" = 6 2/4" or 6 1/2"

E = 8" + 1/4" = 8 1/4"

F = 11"

G = 12"

INFORMATION SHEET

XI. Engineer's scale (Transparencies 16 and 17, Assignment Sheets #5-#7)

A. Rules for reading the scale

1. Select proper scale ratio
2. Be sure scale is laying flat on the surface being measured
3. Double check all measurements
4. Practice measuring from the center of one line to the center of the next line
5. Do not use a scale when dimensions are available

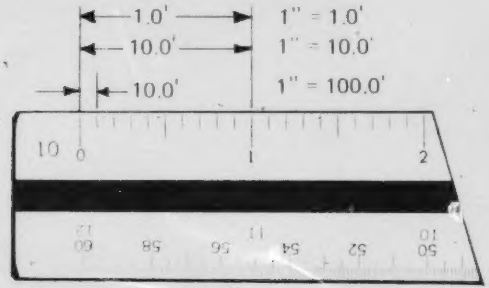
(NOTE: The engineer's scale is used mainly in plot plans, surveys, and other landscape plans.)

B. Common scales used on plans

1. 1" = 1'
2. 1" = 10'
3. 1" = 20'
4. 1" = 30'
5. 1" = 40'
6. 1" = 50'
7. 1" = 60'

C. Interpreting graduations on the engineer's scale

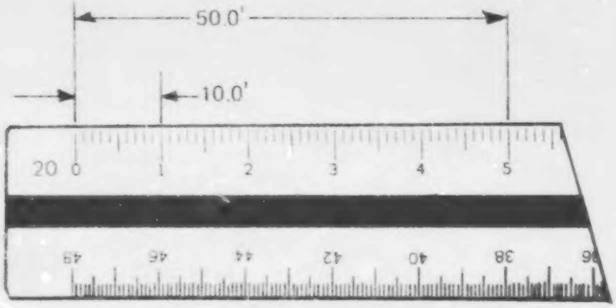
1. 1" = 1' scale



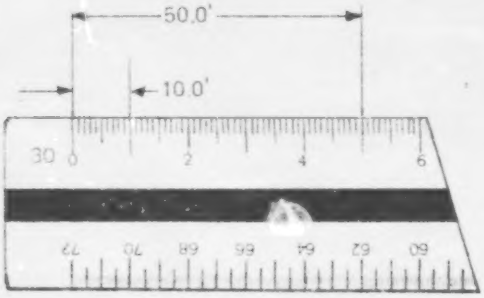
(NOTE: On the 1" = 1' scale, 1" can equal 1.0', 10.0', or 100.0'.)

INFORMATION SHEET

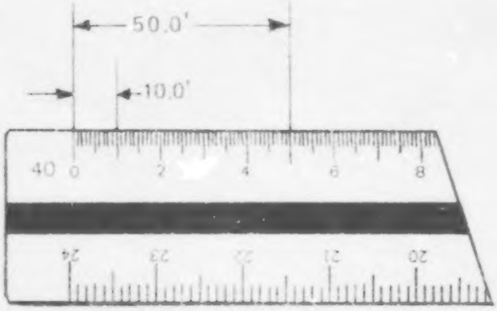
2. 1" = 20'


50.0'
10.0'
20
0
1
2
3
4
5
49
46
44
42
40
38
36

3. 1" = 30'

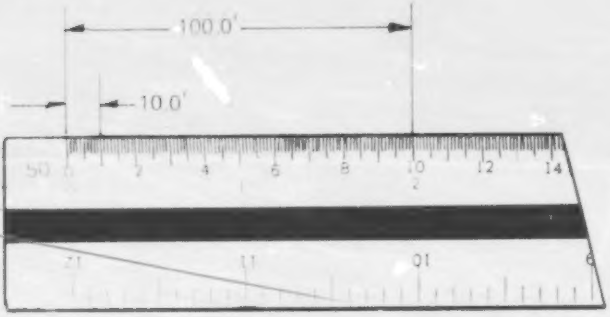

50.0'
10.0'
30
0
2
4
6
72
70
68
66
64
62
60

4. 1" = 40'

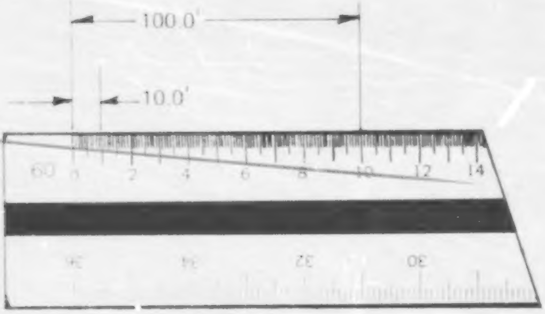

50.0'
10.0'
40
0
2
4
6
8
24
23
22
21
20

INFORMATION SHEET

5. 1" = 50'


100.0'
10.0'
50
0
2
4
6
8
10
12
14
1
2
12
11
10
9

6. 1" = 60'


100.0'
10.0'
60
0
2
4
6
8
10
12
14
36
34
32
30

XII. Major items included in a set of specifications

A. Sizes

B. Types and quality of building materials

C. Methods of construction

D. General requirements

E. Owner's name and address

F. Architect's name

G. Location of new structure

H. Completion date

I. Contractor's bid form

J. Guarantees

K. Insurance requirments

INFORMATION SHEET

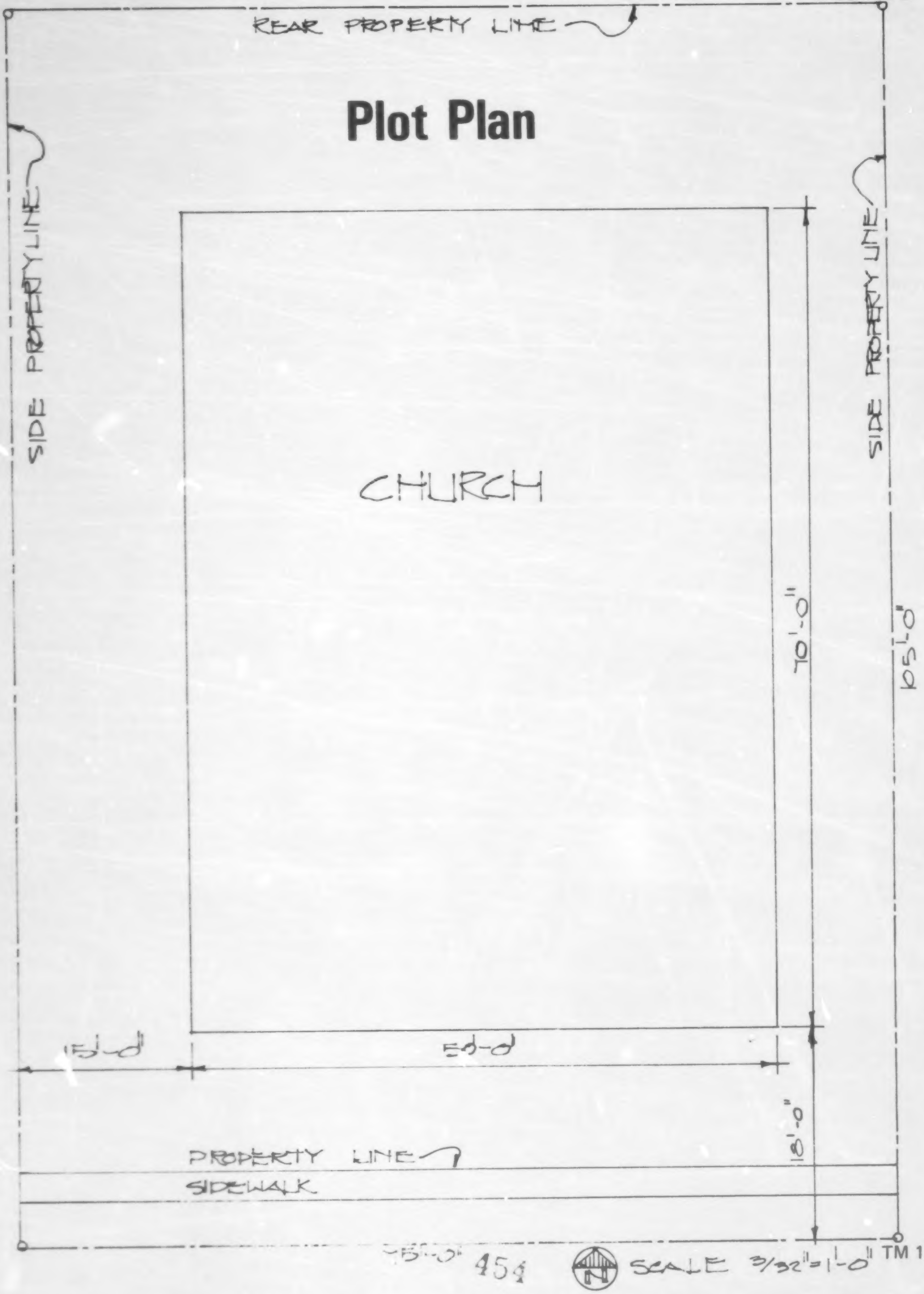
XIII. Specifications and schedules (Transparencies 18 and 19)

(NOTE: Schedules serve two basic purposes: to conserve space on the drawings and to include all information needed to order materials or to do the job.)

- A. Door schedule information
    - 1. Size
        - a. Width
        - b. Height
        - c. Thickness
    - 2. Material
    - 3. Design
    - 4. Hardware
    - 5. Head detail
    - 6. Jamb detail
    - 7. Sill detail
    - 8. Remarks
- B. Schedule of hardware
    - 1. Door number
    - 2. Hardware set number
    - 3. Quantity
    - 4. Type
    - 5. Catalog number
- C. Room finish schedule
- D. Column and joist pads, piers, and baseplate schedule
- E. Beam schedule

CC - 25-E

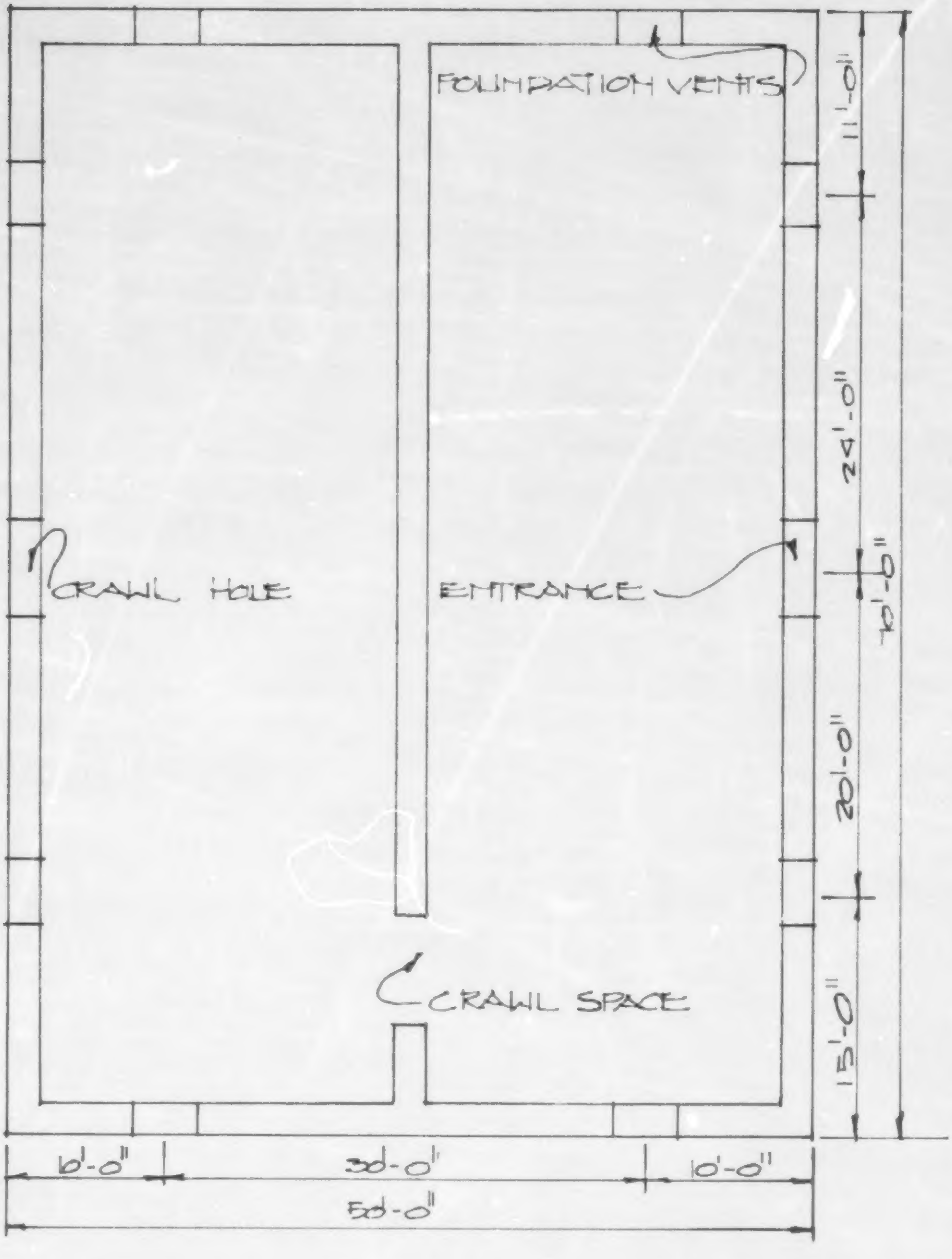
Plot Plan


REAR PROPERTY LINE
SIDE PROPERTY LINE
SIDE PROPERTY LINE
CHURCH
70'-0"
105'-0"
15'-0"
50'-0"
18'-0"
PROPERTY LINE
SIDEWALK
75'-0"

454

SCALE 3/32" = 1'-0" TM 1

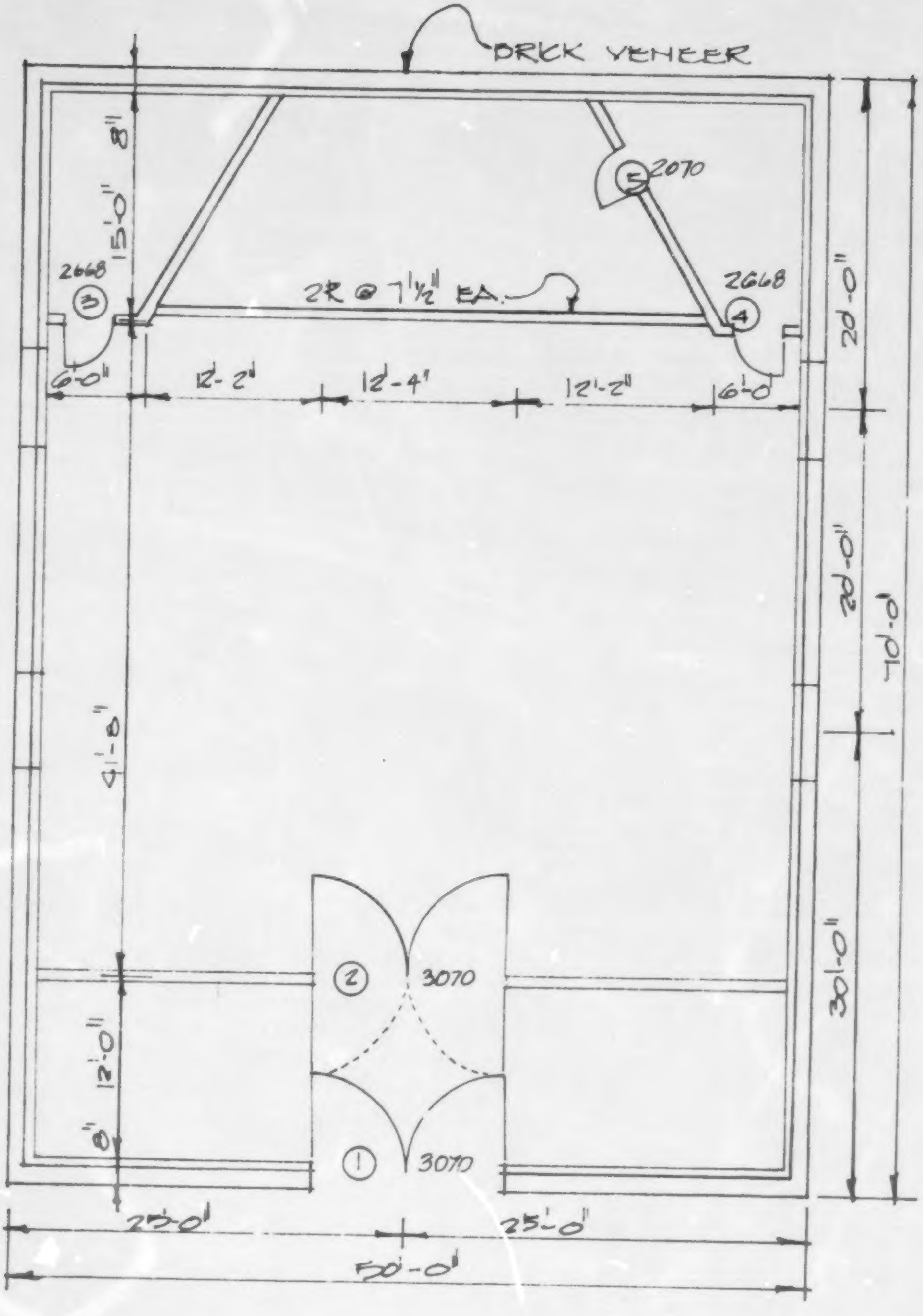
Foundation Plan


FOUNDATION VENTS
CRAWL HOLE
ENTRANCE
CRAWL SPACE
11'-0"
24'-0"
70'-0"
20'-0"
15'-0"
10'-0"
30'-0"
10'-0"
50'-0"

SCALE 3/32" = 1'-0"

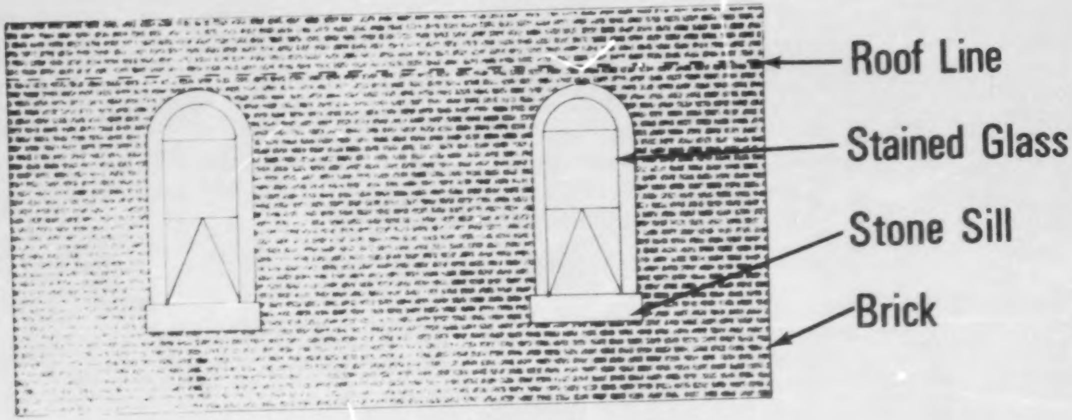
455

Floor Plan

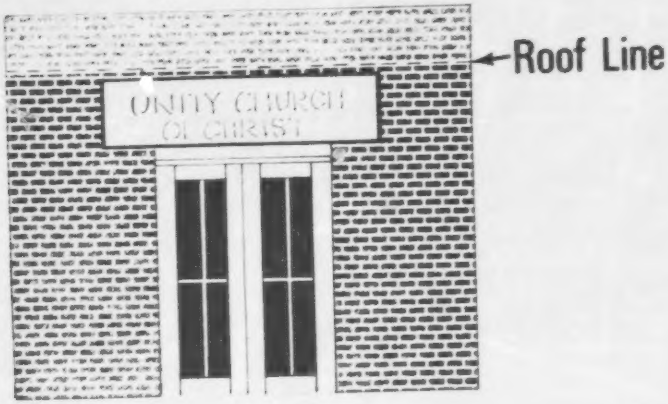

BRICK VENEER
2070
5
15'-0"
8"
2668
3
2R @ 7½" EA.
2668
4
20'-0"
6'-0"
12'-2"
12'-4"
12'-2"
6'-0
20'-0"
70'-0"
41'-8"
2
3070
30'-0"
12'-0"
8"
1
3070
25'-0"
25'-0"
50'-0"

SCALE 3/32" = 1'-0"

Elevations

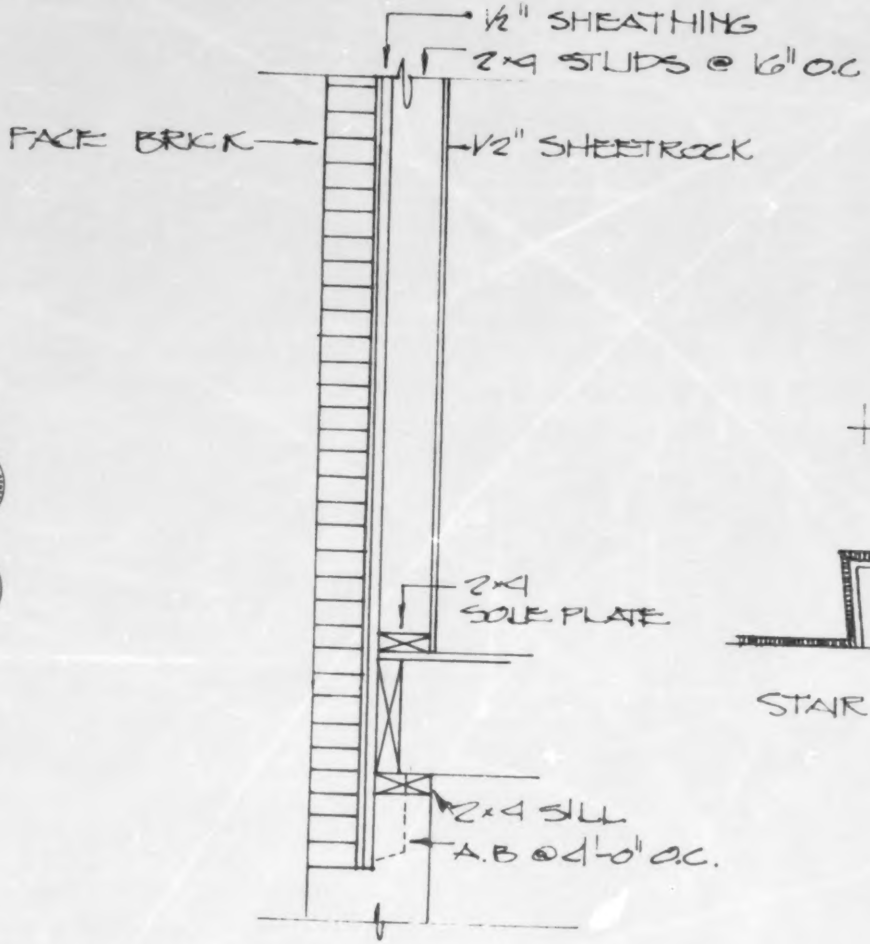

Roof Line
Stained Glass
Stone Sill
Brick

RIGHT SIDE (Left Side Similar)

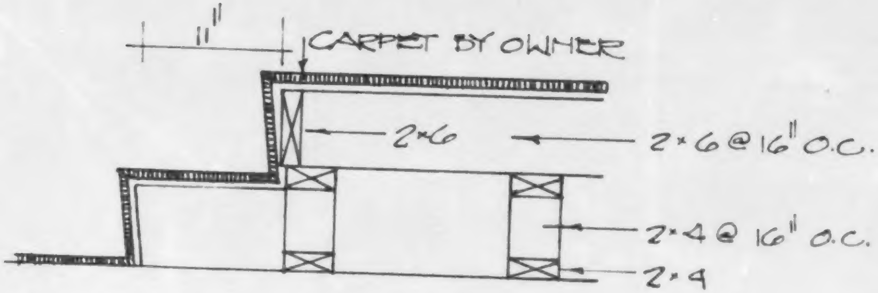

Roof Line
UNITY CHURCH
OF CHRIST

FRONT

Details

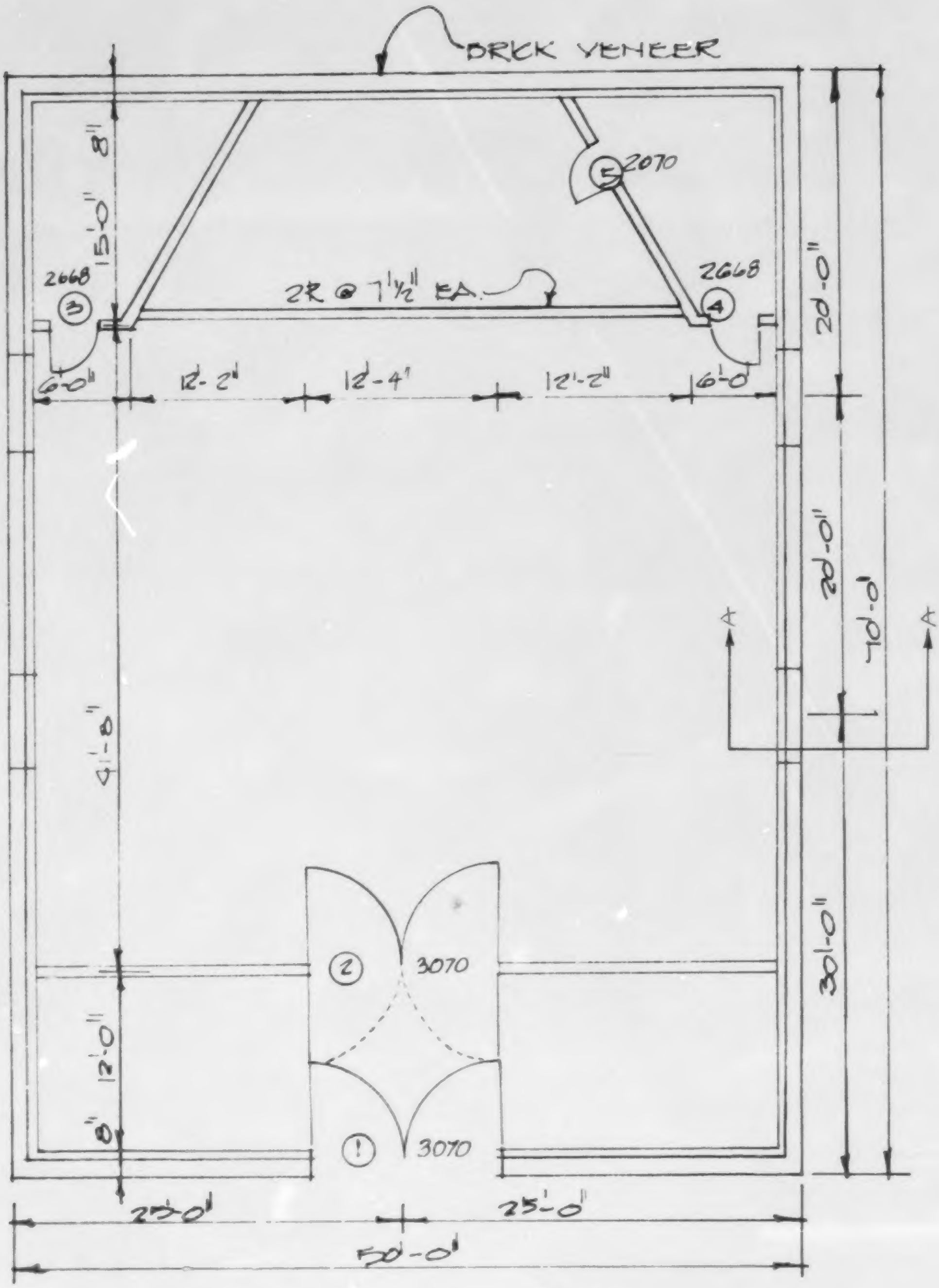

½" SHEATHING
2×4 STUDS @ 16" O.C.
FACE BRICK
1/2" SHEETROCK
2×4 SOLE PLATE
2×4 SILL
A.B @ 4'-0" O.C.

TYPICAL EXTERIOR WALL SCALE 1"=1'-0"


11"
CARPET BY OWNER
2×6
2×6 @ 16" O.C.
2×4 @ 16" O.C.
2×4

STAIR & PLATFORM SCALE 1"=1'-0"

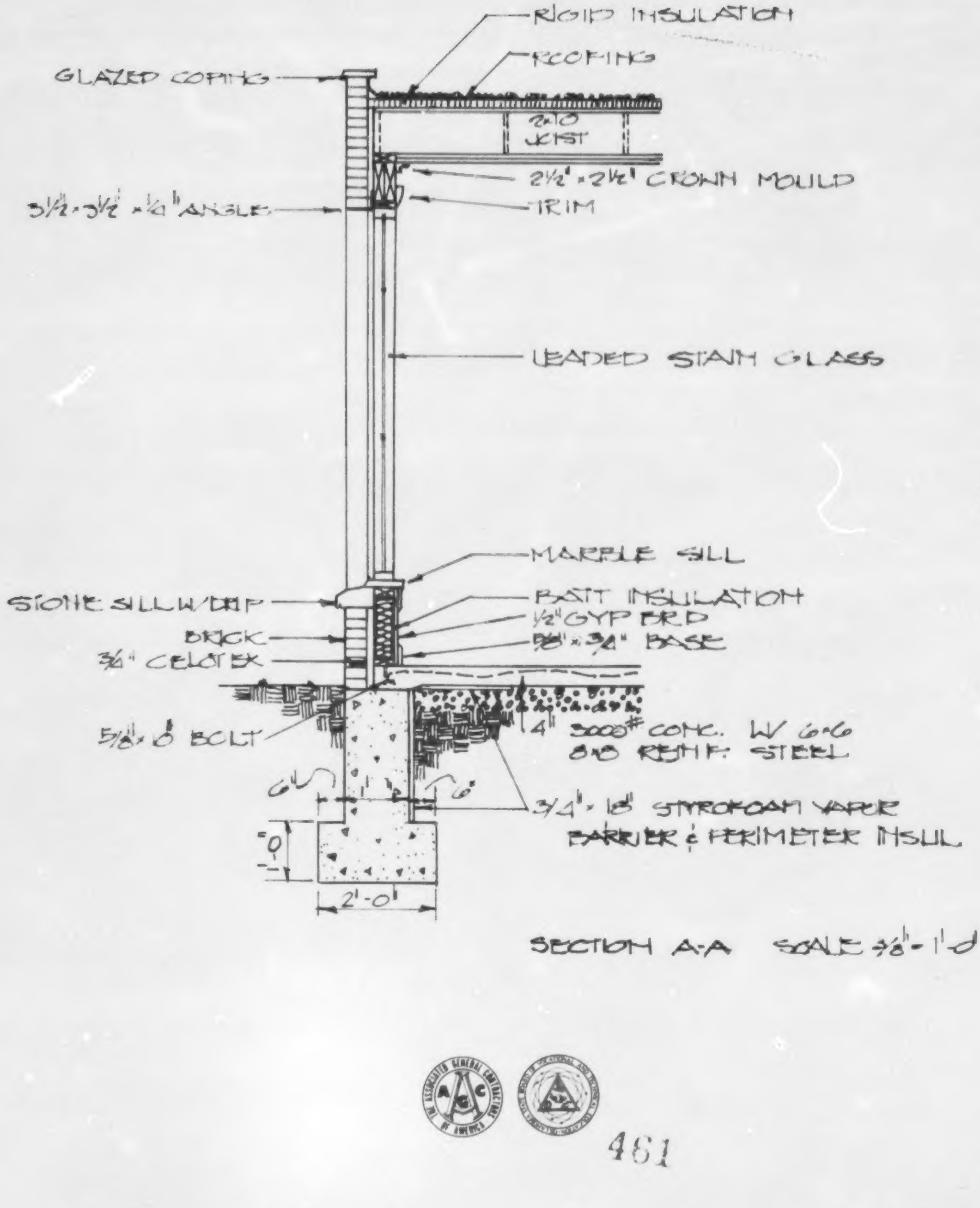
Section Drawing


BRICK VENEER
2070
5
2668
3
2668
4
2R @ 7 1/2" EA.
15'-0"
8"
6'-0"
12'-2"
12'-4"
12'-2"
6'-0"
20'-0"
20'-0"
40'-0"
A
A
41'-8"
30'-0"
2
3070
12'-0"
8"
1
3070
25'-0"
25'-0"
50'-0"

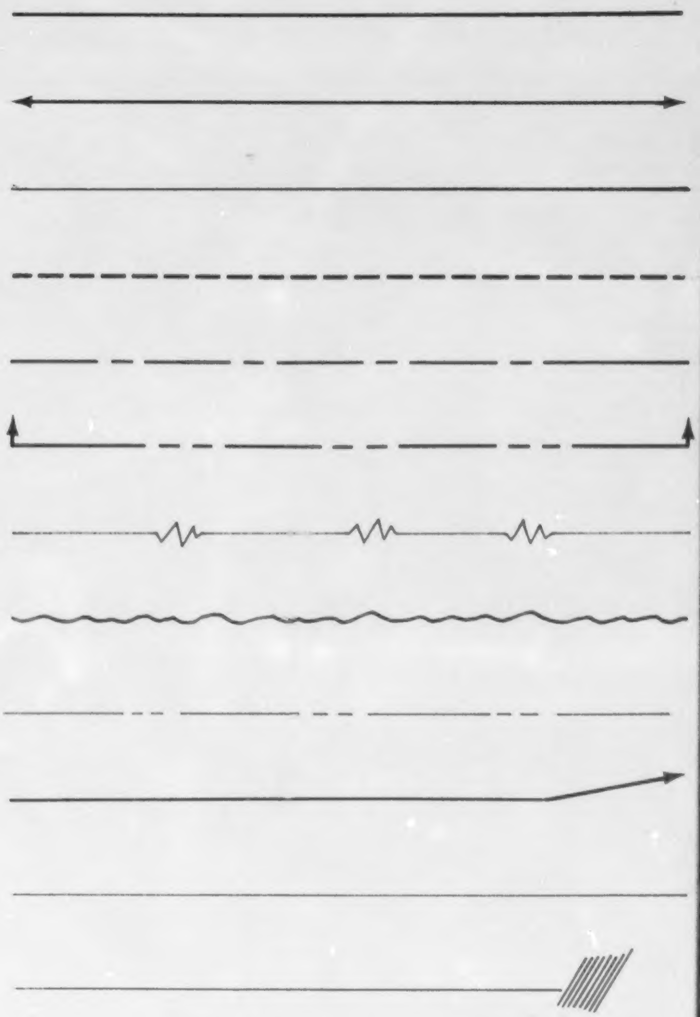
Section AA is shown on Transparency 7. SCALE 3/32" = 1'-0"

Section Drawing

(Continued)


RIGID INSULATION
ROOFING
GLAZED COPING
2x10 JOIST
2½" x 2½" CROWN MOULD
3½ x 3½ x ¼" ANGLE
TRIM
LEADED STAIN GLASS
MARBLE SILL
STONE SILL W/DRIP
BATT INSULATION
½" GYP BRD
5/8" x 3/4" BASE
BRICK
3/4" CELOTEX
5/8 x 10" BOLT
4" 3000# CONC. W/ 6x6 8/8 REINF. STEEL
6"
6"
3/4" x 18" STYROFOAM VAPOR BARRIER & PERIMETER INSUL
10"
2'-0"
SECTION A-A SCALE 3/8" = 1'-0"

Alphabet of Lines



Object Line

Dimension Line

Extension Line

Hidden Line

Center Line

Section Line

Break Line-Long

Break Line-Short

Phantom Line

Leader

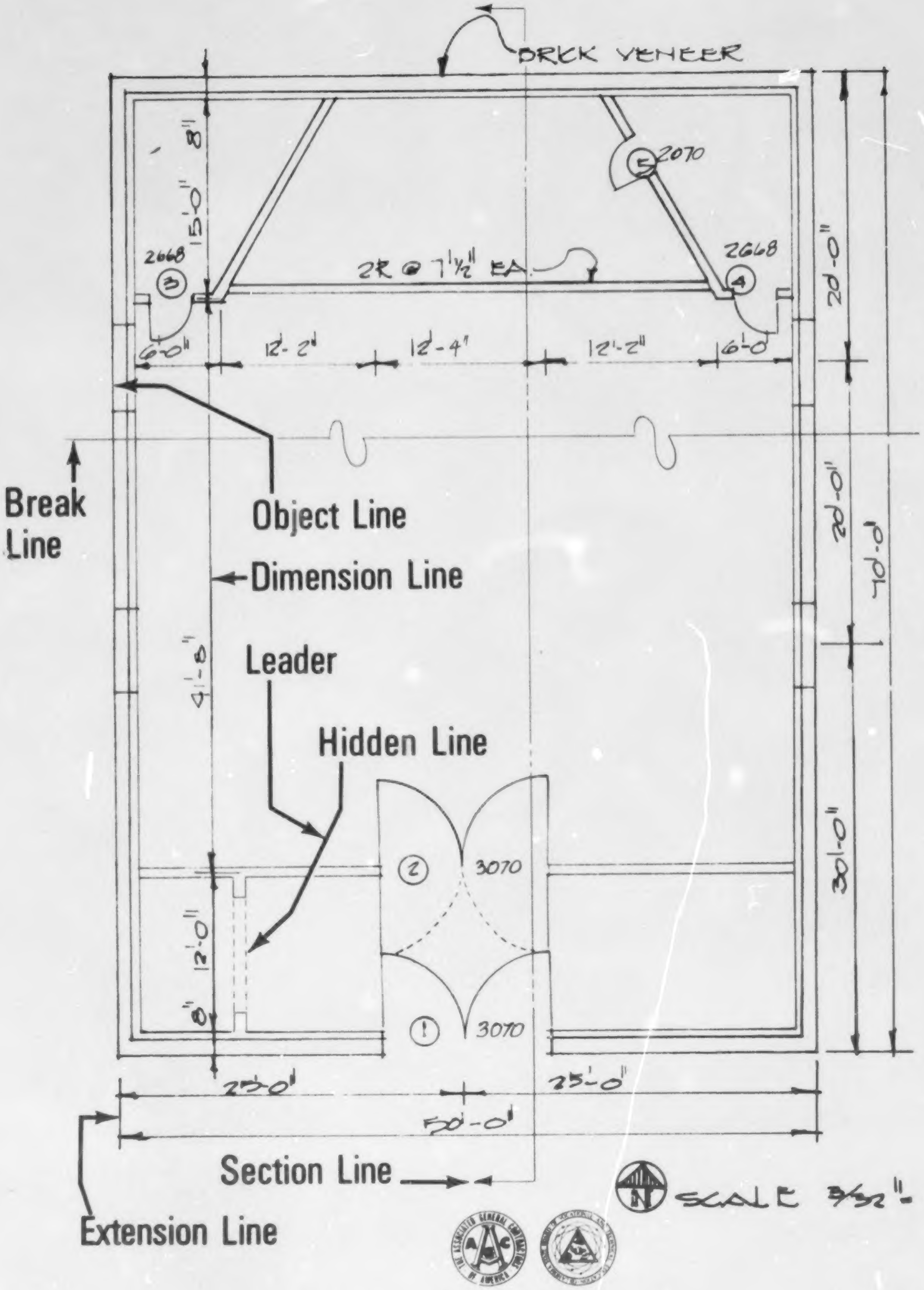
Fixture Line

Section Lining

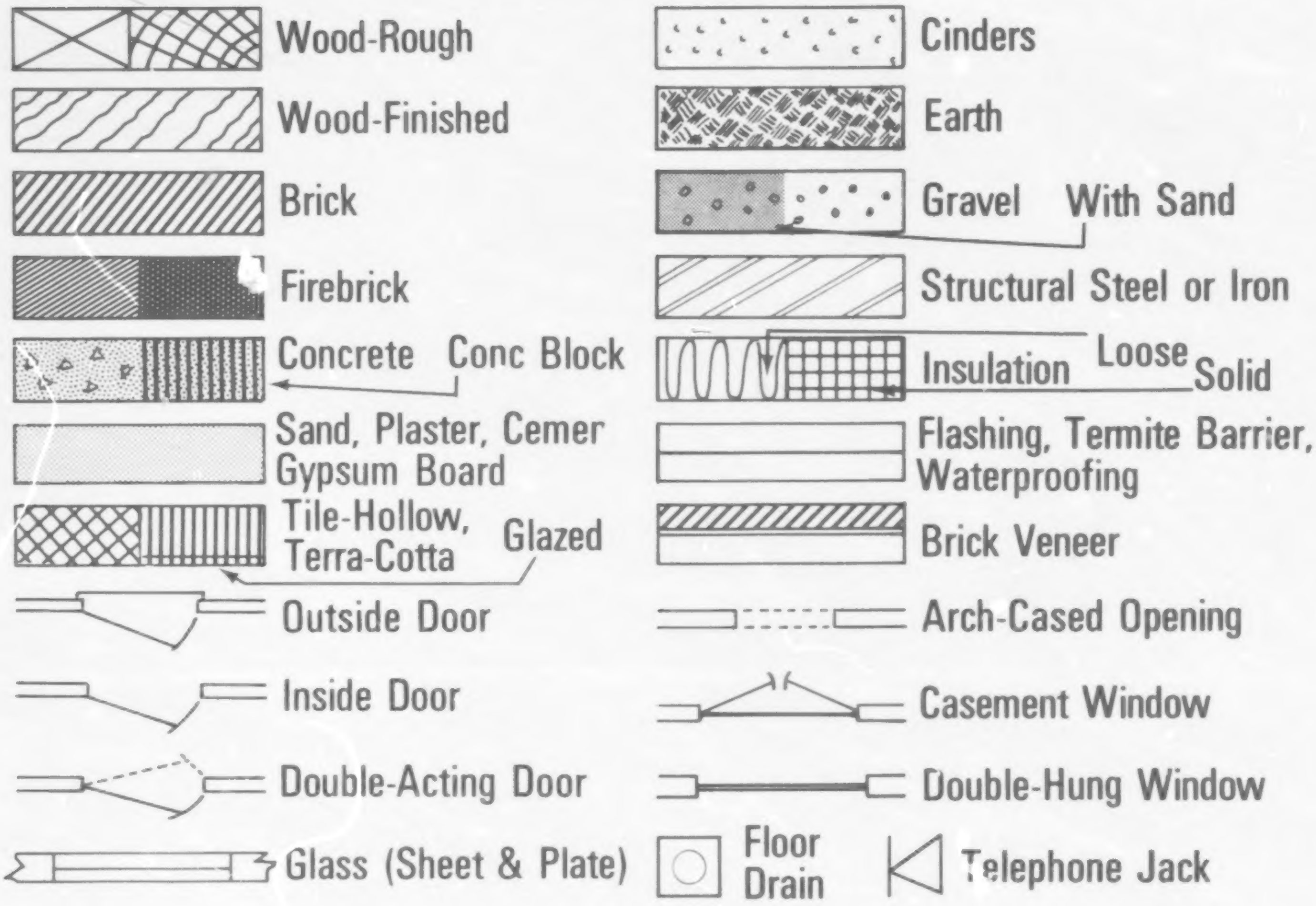
TM 8

Alphabet of Lines

(Continued)


BRCK VENEER
⑤ 2070
2668
③
2R @ 7 1/2" EA
2668
④
15'-0"
8"
20'-0"
6'-0"
12'-2"
12'-4"
12'-2"
6'-0"
Break Line
Object Line
Dimension Line
20'-0"
70'-0"
41'-8"
Leader
Hidden Line
② 3070
30'-0"
12'-0"
8"
① 3070
25'-0"
25'-0"
50'-0"
Section Line
Extension Line
SCALE 3/32" = 1'-0"

Floor Plan Symbols

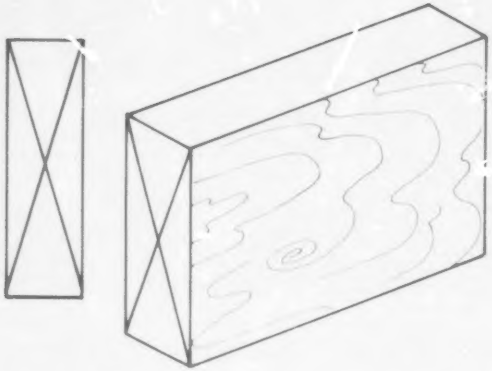

Wood-Rough
Wood-Finished
Brick
Firebrick
Concrete
Conc Block
Sand, Plaster, Cemer
Gypsum Board
Tile-Hollow,
Terra-Cotta
Glazed
Outside Door
Inside Door
Double-Acting Door
Glass (Sheet & Plate)
Cinders
Earth
Gravel
With Sand
Structural Steel or Iron
Insulation
Loose
Solid
Flashing, Termite Barrier,
Waterproofing
Brick Veneer
Arch-Cased Opening
Casement Window
Double-Hung Window
Floor
Drain
Telephone Jack

Electrical Symbols

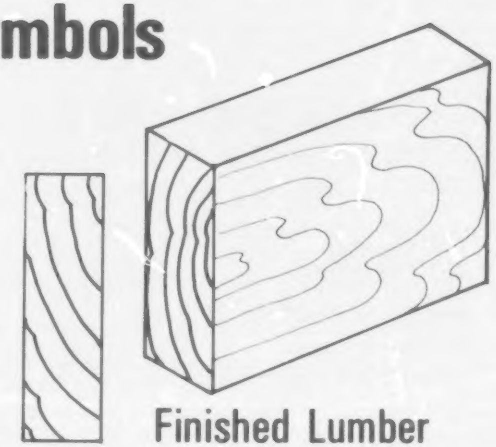
⊜	**Duplex Receptacle Outlet**
⊜G	**Duplex Grounding Outlet**
○	**Ceiling Lighting Outlet**
=△	**Duplex Special Purpose Receptacle Outlet**
⊖WP	**Weatherproof Outlet**
—▲	**Special Purpose Outlet**
—⊗	**Exit Light Outlet**
—Ⓙ	**Junction Box**
⊜R	**Range Outlet**
—⊖S	**Switch and Single Receptacle**
—Ⓕ	**Fan Outlet**

S	**Single Pole Switch**
S_2	**Double Pole Switch**
S_3	**Three Way Switch**
S_4	**Four Way Switch**
S_P	**Switch and Pilot Lamp**
S_{WP}	**Weatherproof Switch**
S_F	**Fused Switch**
Ⓣ	**Thermostat**
⬚	**Ceiling Lighting Outlet for Recessed Fixture**
■	**Lighting Panel**
▨	**Power Panel**

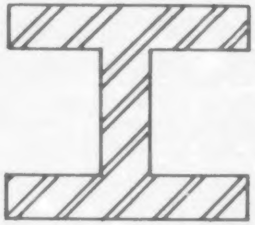
Sectioning Symbols



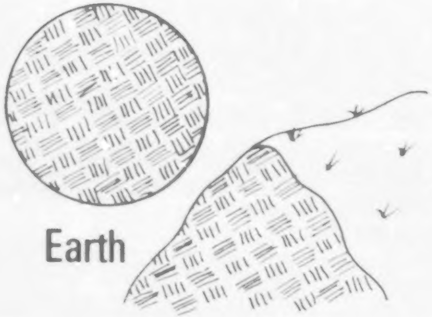
Rough Lumber



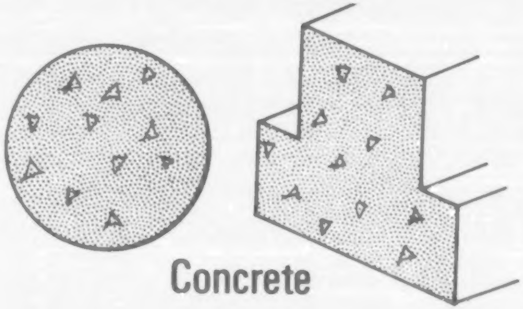
Finished Lumber



Metal

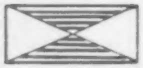


Earth

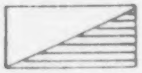


Concrete

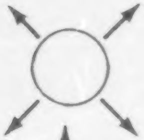
Mechanical Symbols



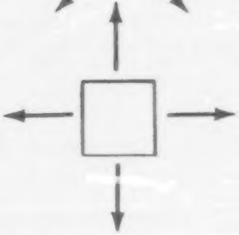
Supply duct section



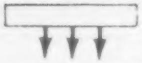
Exhaust, Return, or Outside Air Duct Section



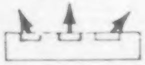
Supply Outlet; Ceiling Diffuser



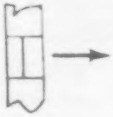
Supply Outlet; Ceiling Diffuser



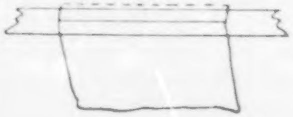
Linear Diffuser



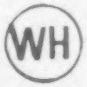
Unit Heater



Louver Opening

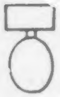


Intake Louvers

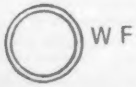


Water Heater

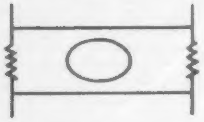
Water Closet



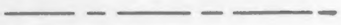
Wash Fountain



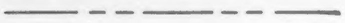
Lavatory



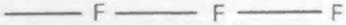
Cold Water



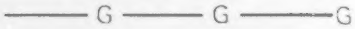
Hot Water



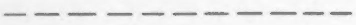
Fire Line



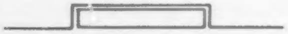
Gas--Low Pressure



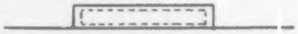
Vent



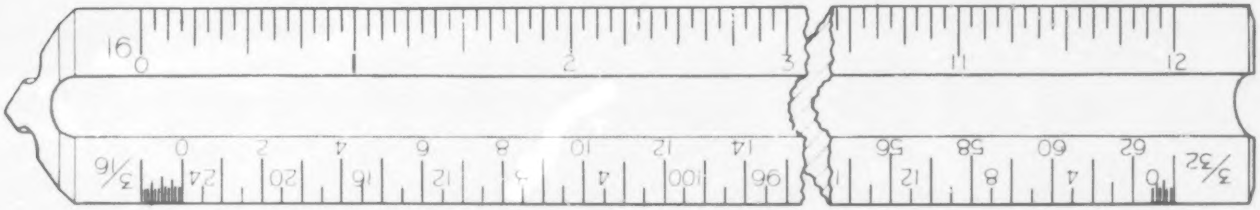
Recessed Radiator



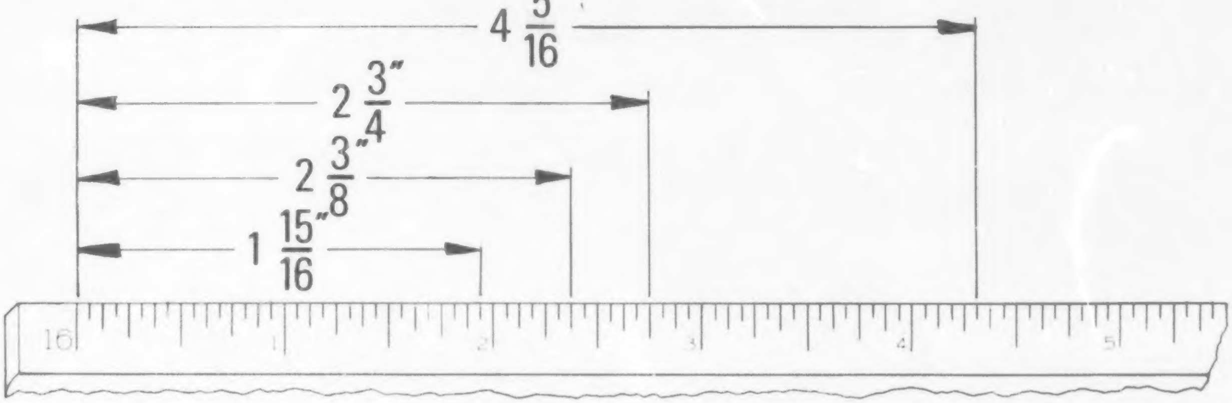
Enclosed Radiator



Architect's Scale

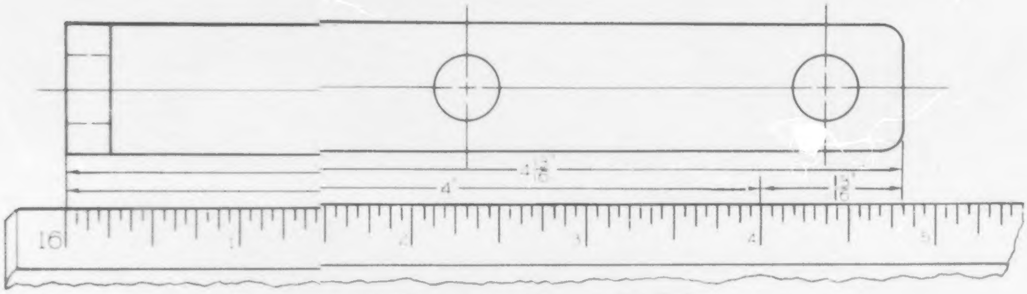

16
0
1
2
3
11
12
3/16
0
2
4
6
8
10
12
14
24
20
16
12
8
4
100
96
56
58
60
62
0
3/32

This is how the Architect's Scale should look.

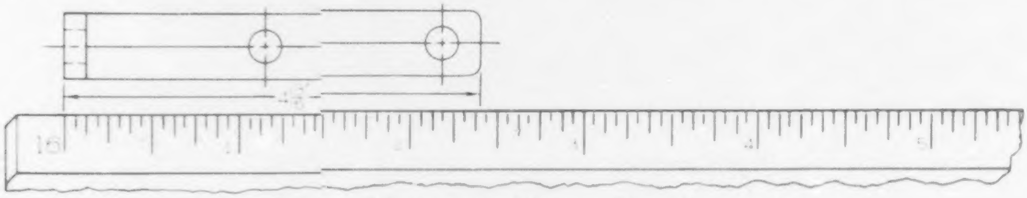

4 5/16"
2 3/4"
2 3/8"
1 15/16"
16
1
2
3
4
5

Measurements at Scale of 12" = 1'-0"

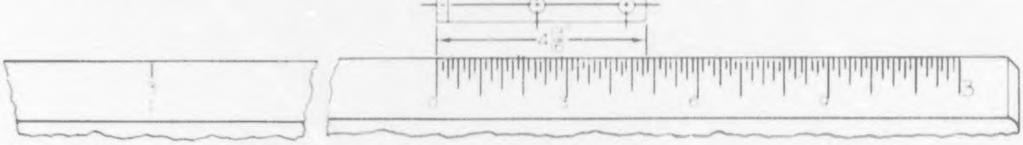
Comparison of Solid Objects


$4\frac{13}{16}$"
4"
$\frac{13}{16}$"
16
1
2
3
4
5

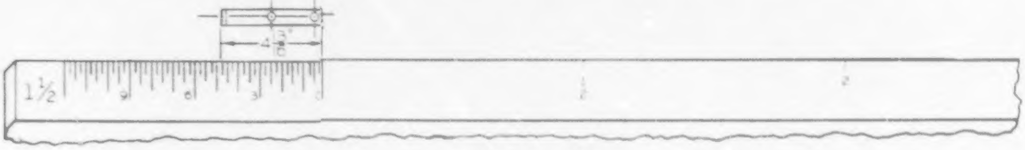
Full Scale 12" = 1'-0"


$4\frac{13}{16}$"
16
1
2
3
4
5

Half Scale 6" = 1'-0"

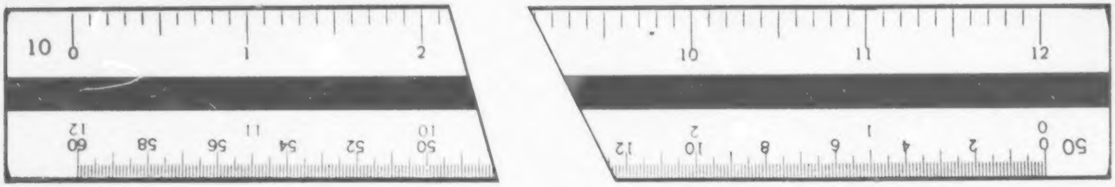

$4\frac{13}{16}$"
0
3
6
9
3

One-Fourth Scale 3" = 1'-0"


$4\frac{13}{16}$"
1½
9
6
3
0
1
2

One-Eighth Scale 1½" = 1'-0"

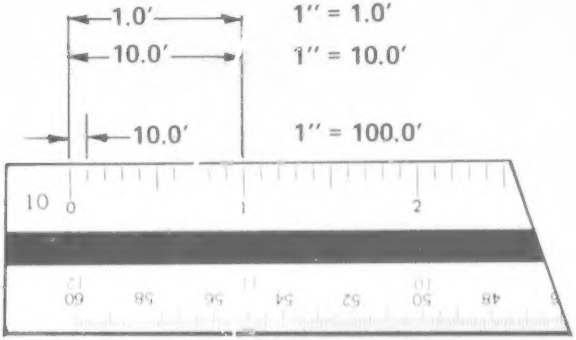
Engineer's Scale


10
0
1
2
10
11
12
60
58
56
54
52
50
12
11
10
50
0
2
4
6
8
10
12
1
2

Engineer's Scale

Examples for Reading

This scale can be used to read:


1.0′
10.0′
10.0′
10
0
1
2
60
58
56
54
52
50
48
12
11
10

1″ = 1.0′

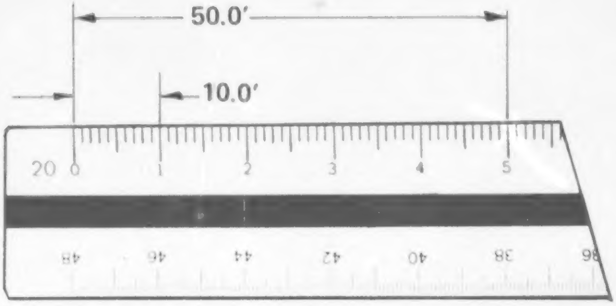
1″ = 10.0′

1″ = 100.0′

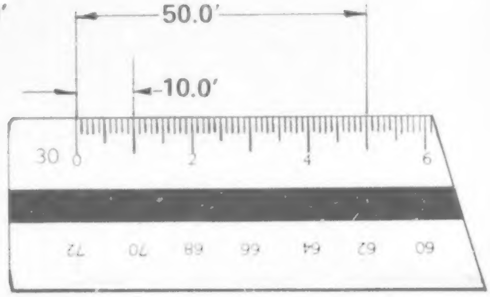
Engineer's Scale

(Continued)

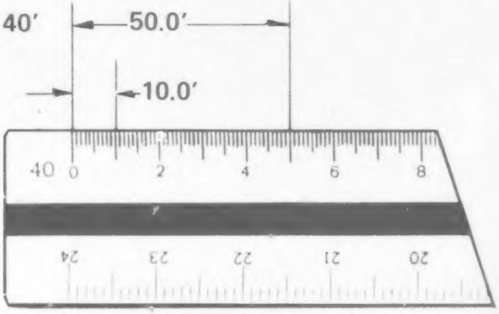
1" = 20'


50.0'
10.0'
20
0
1
2
3
4
5
48
46
44
42
40
38
36

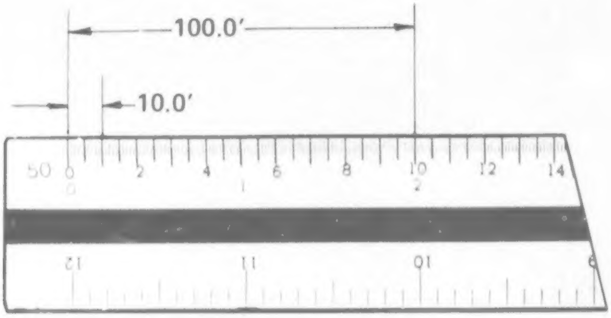
1" = 30'


50.0'
10.0'
30
0
2
4
6
72
70
68
66
64
62
60

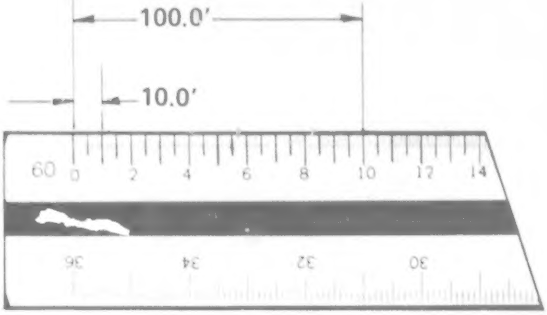
1" = 40'


50.0'
10.0'
40
0
2
4
6
8
24
23
22
21
20

1" = 50'

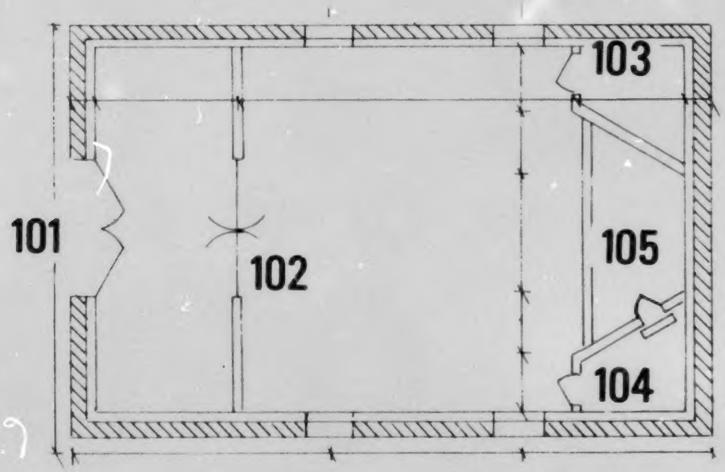

100.0'
10.0'
50
0
2
4
6
8
10
12
14
12
11
10
9

1" = 60'


100.0'
10.0'
60
0
2
4
6
8
10
12
14
36
34
32
30

Door Schedule

No.	Size	Material	Design	Hardware	Head	Jamb	Sill	Remarks
101	3070×1¾ Pr	Oak	A	2	3/9	4/9	10/9	Threshold
102	3070×1¾ Pr	Oak	A	1	3/9	4/9	11/9	
103	2668×1½	Oak	B	3	3/9	4/9	11/9	
104	2668×1½	Oak	B	3	3/9	4/9	12/9	
105	2068×1½	Oak	B	3	3/9	4/9	12/9	



Door Schedule

Door No.	Hardware Set	Owners Number
101	2	1
102	1	2
103	3	3
104	3	4
105	3	5

Set 1	Pr of D.A. Vestibule to Chapel	
2 Pr	Spring Hinges	3029– USP–8
1	Exten. Flush Bolt	C457B10×12
4	Floor Stops	446B10
4	Push Plates	39–6X16–US10

Set 2	Pr Exterior to Vestibule	
3 Pr	Butts	BB1193–US10–4½×4½ NRP
2	Door Closers	C–RA–X–DB
2	Exit Device	8827 × 8858E0 × US10
1	Threshold	3151-A
1 Set	Weather Strip	332 AR (Lip & Sides)
1 Pr	Astragel	305 BN

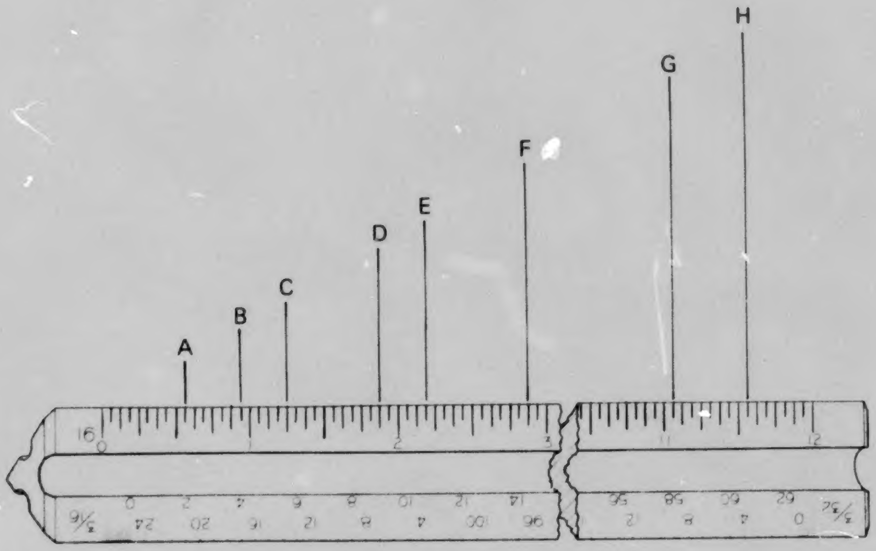
Set 3	Storage to Chapel	
1½ Pr	Butts	1279–US10–4×4
1	Lockset	HCE–131DL×US10
1	Door Closer	C–RA×DB

Hardware Schedule

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #1--READ THE ARCHITECT'S SCALE USING FULL SCALE OR (12" = 1')

Read the measurements shown below at full scale by reading the distance from 0 at left to points indicated on the scale with letters.

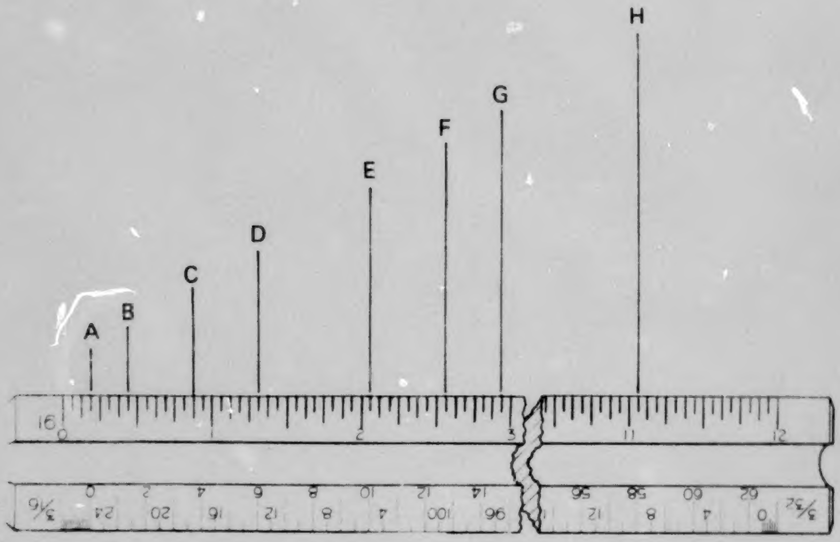

A
B
C
D
E
F
G
H
16
0
1
2
3
11
12
3/16
3/32

1. A =
2. B =
3. C =
4. D =
5. E =
6. F =
7. G =
8. H =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #2--READ THE ARCHITECT'S SCALE USING HALF SCALE OR (6" = 1')

Read the measurements shown below at half scale by reading the distance from 0 at left to points indicated on the scale with letters.


A
B
C
D
E
F
G
H
16
0
1
2
3
11
12
3/16
3/32

1. A =

2. B =

3. C =

4. D =

5. E =

6. F =

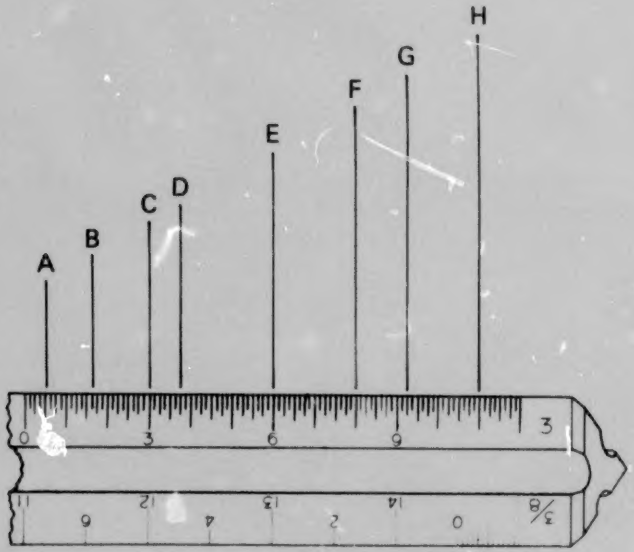
7. G =

8. H =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #3--READ THE ARCHITECT'S SCALE USING ONE-FOURTH SCALE OR (3" = 1')

Read the one-fourth scale shown below by reading the distance from 0 at left to points indicated on the scale with letters.

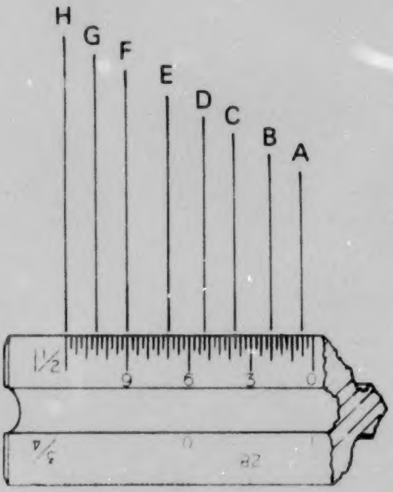

H
G
F
E
C
D
B
A
0
3
6
9
3
11
9
12
4
13
2
14
0
3/8

1. A =
2. B =
3. C =
4. D =
5. E =
6. F =
7. G =
8. H =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #4--READ THE ARCHITECT'S SCALE USING ONE-EIGHTH SCALE OR (1 1/2" = 1')

Read the one-eighth scale shown below by reading the distance from 0 at right to points indicated on the scale with letters.

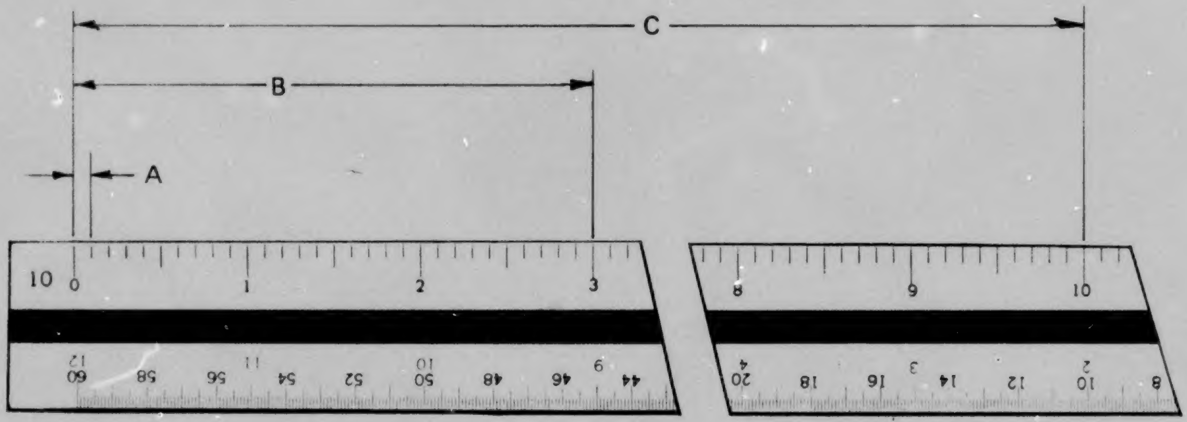


1. A =
2. B =
3. C =
4. D =
5. E =
6. F =
7. G =
8. H =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #5--READ THE ENGINEER'S SCALE USING SCALE OF 1" = 1'

Read the measurements shown below at 1" = 1' scale reading the distance from 0 at left to points indicated on the scale.

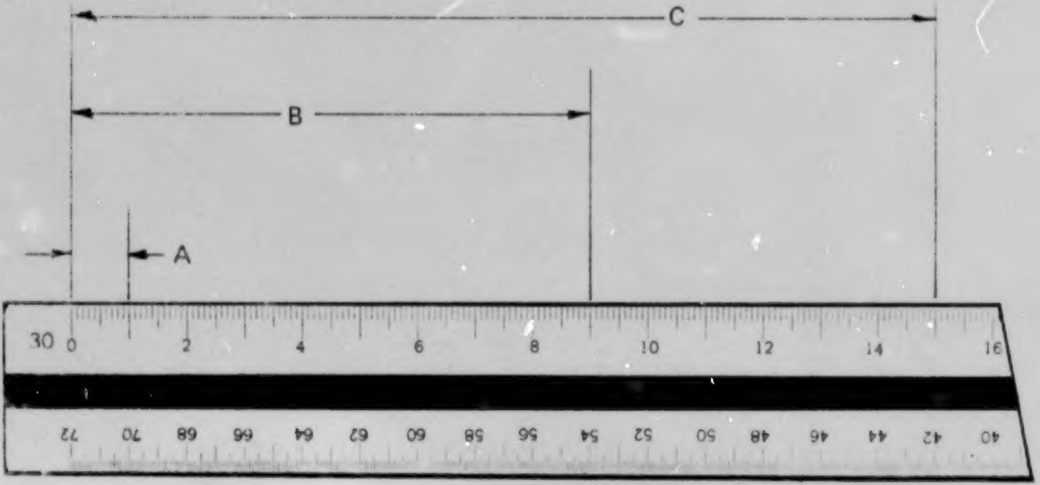


1. A =
2. B =
3. C =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #6--READ THE ENGINEER'S SCALE USING SCALE OF 1" = 30'

Read the measurements shown below at 1" = 30' scale reading the distance from 0 at left to points indicated on the scale.

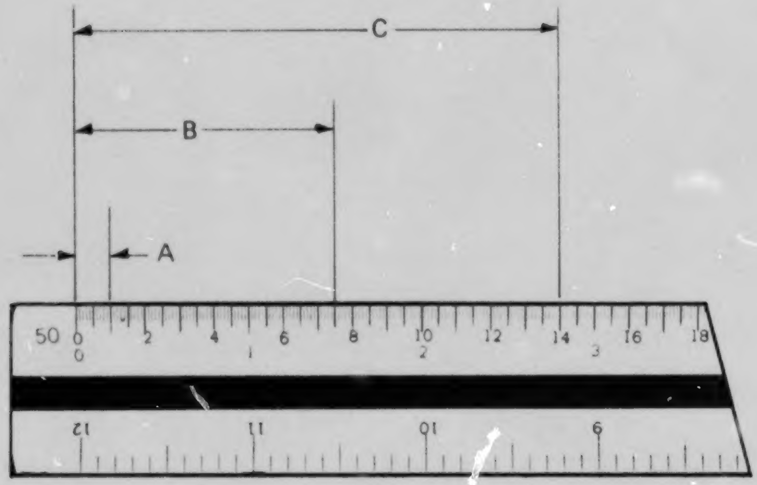

C
B
A
30
0
2
4
6
8
10
12
14
16
72
70
68
66
64
62
60
58
56
54
52
50
48
46
44
42
40

1. A =
2. B =
3. C =

BLUEPRINT READING
UNIT I

ASSIGNMENT SHEET #7--READ THE ENGINEER'S SCALE USING SCALE OF 1" = 50'

Read the measurements shown below at 1" = 50' scale reading the distance from 0 at left to points indicated on the scale.


C
B
A
50
0
2
4
6
8
10
12
14
16
18
0
1
2
3
12
11
10
9

1. A =

2. B =

3. C =

BLUEPRINT READING
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. 9/16"
2. 15/16"
3. 1 1/4"
4. 1 7/8"
5. 2 3/16"
6. 2 7/8"
7. 11 1/16"
8. 11 9/16"

Assignment Sheet #2

1. 3/8"
2. 7/8"
3. 1 3/4"
4. 2 5/8"
5. 4 1/8"
6. 5 1/8"
7. 5 7/8"
8. 22 1/8"

Assignment Sheet #3

1. 1/2"
2. 1 5/8"
3. 3"
4. 3 3/4"
5. 6"

6. 8"
7. 9 1/4"
8. 11"

Assignment Sheet #4

1. 1/2"
2. 2"
3. 3 3/4"
4. 5 1/4"
5. 7"
6. 9"
7. 10 1/2"
8. 12"

Assignment Sheet #5

1. 0.1' or 1.0' or 10.0'
2. 3.0' or 30.0' or 300.0'
3. 10.0' or 100.0' or 1000.0'

Assignment Sheet #6

1. 10.0'
2. 90.0'
3. 150.0'

Assignment Sheet #7

1. 10.0'
2. 75.0'
3. 140.0'

BLUEPRINT READING
UNIT I

TEST

NAME ____ SCORE ________________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. Terms and definitions are continued on the next page.

______ a. Drawing of an object that has been cut to show internal construction

______ b. Plans showing the structural components of the building

______ c. Detailed set of written instructions which explains the drawing, describes material and equipment used in the structure as to quality and types, and becomes part of the contract

______ d. Arbitrary sign that has been standardized and is used to represent an object, quality, or method

______ e. Plans showing the plumbing and heating layout

______ f. Graphic representations shown with lines and symbols

______ g. Drawing that gives complete detailed information for an element of construction

______ h. Set of conventional symbols covering all the lines needed to depict an object as to size and shape

______ i. Arrangement of lines and symbols to indicate the actual size for constructing the object that is represented

______ j. In architecture, a diagram showing a horizontal view of a structure, such as floor plans and sectional plans

______ k. Rule divided into proportional feet and inches; a fraction of an inch is proportionally equal to one foot

______ l. Drawings representing the front, sides, or rear face of a structure and usually made as though the observer were looking straight at it

1. Alphabet of lines
2. Architectural drawings
3. Structural drawing
4. Detail
5. Section
6. Specifications
7. Symbol
8. Mechanical drawing
9. Architect's scale
10. Plan
11. Dimensions
12. Elevation

_____m. Copy of the original detailed drawing

_____n. Drawing made to a size either proportionally larger or smaller than the actual size of the object represented

_____o. Plans showing the electrical installation

_____p. Plans showing detailed information of specific items

_____q. Point with reference to which elevations are measured or indicated, such as a permanent bench mark

_____r. Set of orders issued and signed by owner authorizing contractor to make a particular change

_____s. Rule divided into decimals and/or tenths

_____t. Metal or stone marker placed in the ground by a surveyor with the elevation indicated on it

13. Blueprint
14. Scale drawing
15. Electrical drawing
16. Shop drawing
17. Engineer's scale
18. Bench mark (BM)
19. Datum point
20. Change orders

2. Identify the types of architectural drawings pictured below and on the next pages.

a. ______________________________

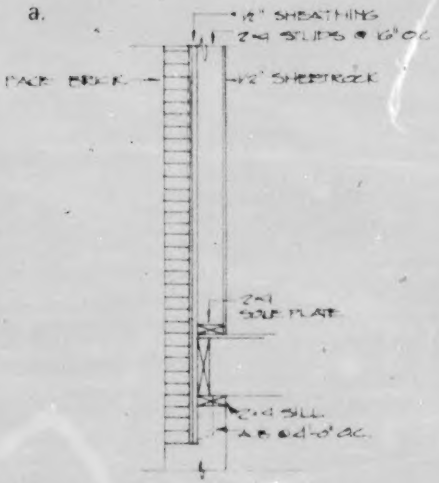
b. ______________________________

c. ______________________________

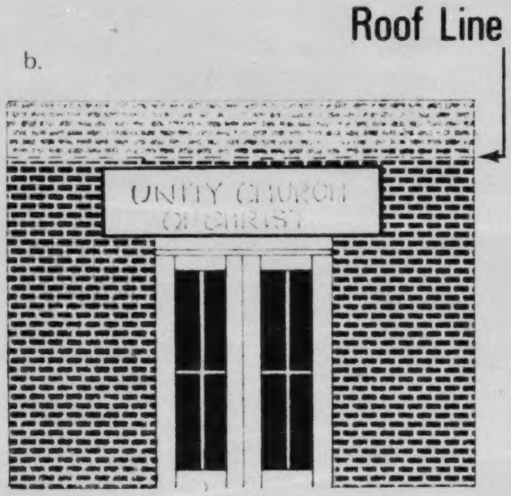
d. ______________________________

e. ______________________________

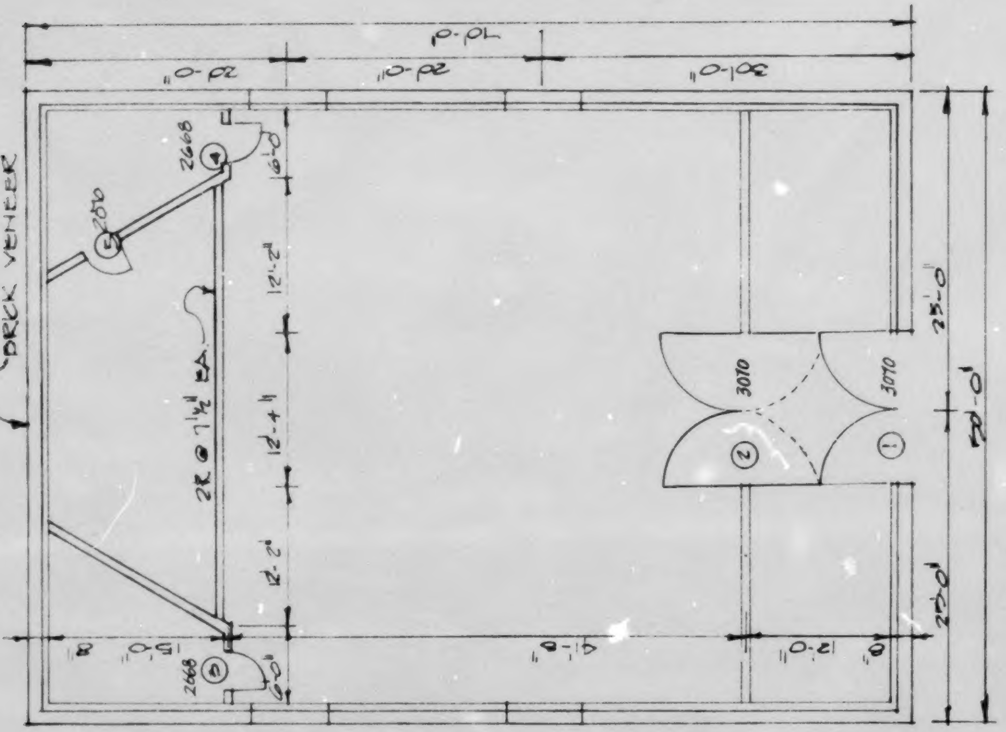
a.


½" SHEATHING
2×4 STUDS @ 16" OC
FACE BRICK
½" SHEETROCK
2×4 SOLE PLATE
2×4 SILL
A B @ 4'-0" OC

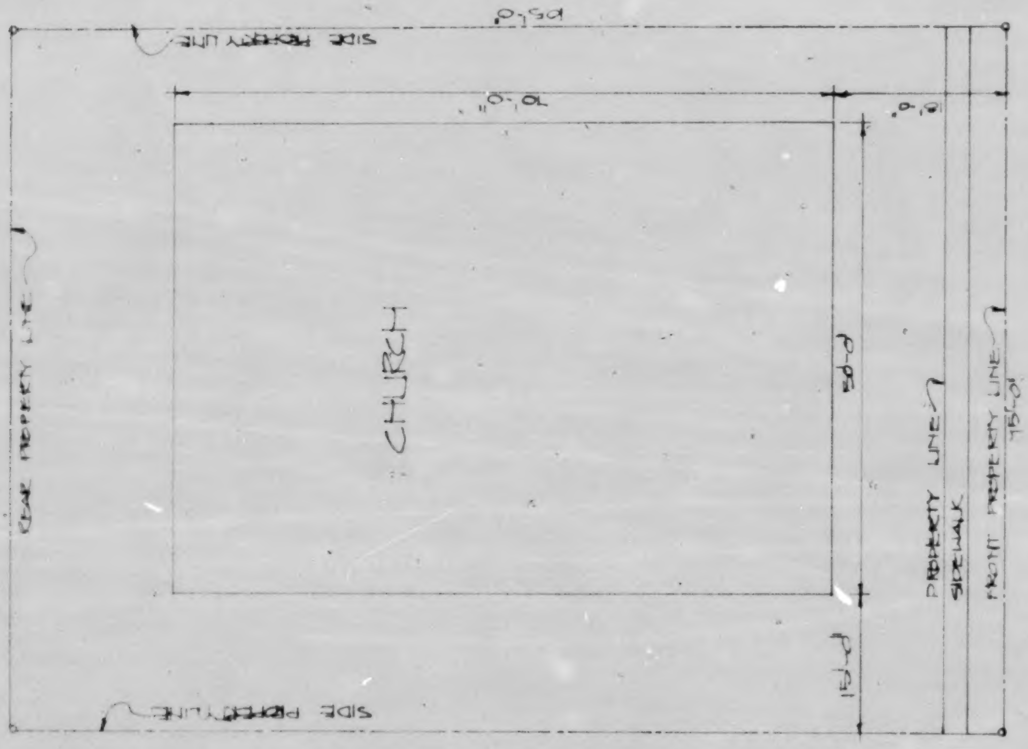
b.


Roof Line
UNITY CHURCH OF CHRIST

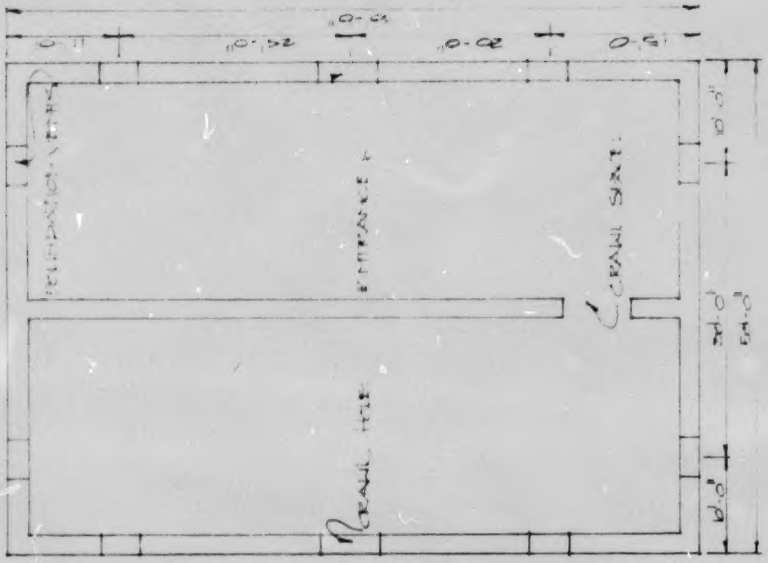
c.


70'-0"
20'-0"
20'-0"
30'-0"
BRICK VENEER
2668
2050
6'-0"
12'-2"
12'-4"
12'-2"
2R @ 7 1/2" EA.
3070
3070
②
①
25'-0"
50'-0"
25'-0"
8"
15'-0"
41'-0"
12'-0"
8"
2668
6'-0"

d.


105'-0"
SIDE PROPERTY LINE
70'-0"
10'-0"
CHURCH
50'-0"
15'-0"
REAR PROPERTY LINE
PROPERTY LINE
SIDEWALK
FRONT PROPERTY LINE
75'-0"
SIDE PROPERTY LINE

e.



3. Classify types of architectural drawings according to their characteristics. Place a (P) in front of characteristics of a plot plan, an (FO) for foundation plan, an (FL) for floor plan, an (E) for elevation, and a (D) for details.

_____a. Location of the structure on the site

_____b. Location and size of footings, grade beams, foundation walls, stem walls, and piers

_____c. Outside walls including the location and dimensions of all exterior openings

_____d. Grade lines, floor heights, window sizes, roof lines, and/or other dimensions

_____e. Finished and existing grade contours

_____f. Property lines

_____g. Windows

_____h. Type of construction through the use of symbols

_____i. Doors (interior and exterior)

_____j. Location of existing conditions

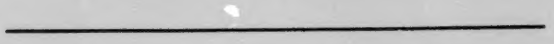
_____k. Walls and partitions

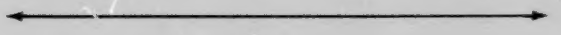
_____l. Location of cabinets and other built-ins

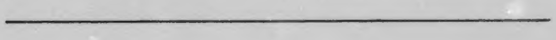
_____m. Mill work, trim, and specialty items

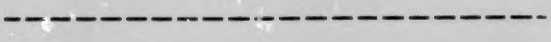
_____n. Utilities

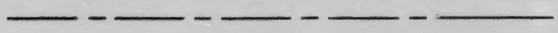
4. Identify the types of lines shown below.

a. ____________________


b. ____________________


c. ____________________


d. ____________________


e. ____________________


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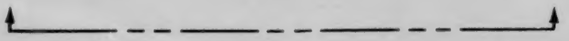

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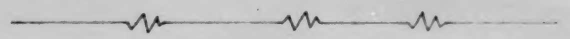

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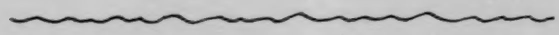

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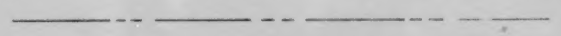
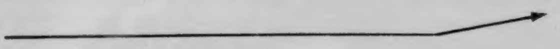
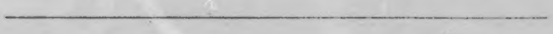
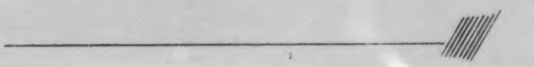


j. ____________________


k. ____________________


l. ____________________


5. Match the types of lines on the right to their descriptions by placing the appropriate numbers in the blanks provided.

_____a. Show main outline of the structure, including exterior walls, interior partitions, porches, patios, and driveways

_____b. Thin, unbroken lines which designate structure dimensions

_____c. Extend, but do not touch, the object lines; permit dimension lines to be drawn between them

_____d. Short dashes used to show lines that are not visible from that view

_____e. Series of short and long dashes used to designate centers and provide a reference point for dimensioning

_____f. Heavy lines consisting of a series of one long and two short dashes with arrows at each end pointing away from the area that is cut away for the purpose of sectioning; show the direction from which the section is supposed to be viewed

_____g. Used when an area cannot or should not be drawn entirely; a ruled line with freehand breaks

_____h. Used when an area cannot or should not be drawn entirely; wavy, uneven freehand line

_____i. Used to indicate alternate positions of moving parts, adjacent positions of related parts, and for repeated details

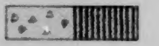
_____j. Outline the shape of equipment and furnishings

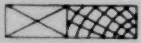
_____k. Used to connect a note or dimension to a part of the structure

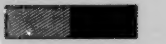
_____l. Used to draw the section lining in sectional drawings; different material symbol is used for each structure material; lightly drawn line

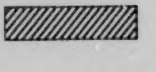
1. Leaders
2. Break lines, long
3. Section lining
4. Fixture lines
5. Dimension lines
6. Extension lines
7. Break lines, short
8. Object lines
9. Center lines
10. Section lines (cutting plane)
11. Phantom lines
12. Hidden lines

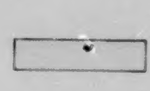
6. Match the names of the floor plan symbols on the right to pictures of the symbols.

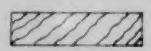
_____a. 

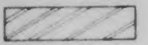
_____b. 

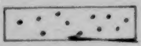
_____c. 

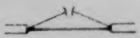
_____d. 

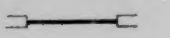
_____e. 

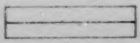
_____f. 

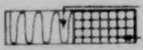
_____g. 

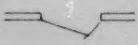
_____h. 

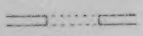
_____i. 

_____j. 

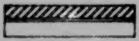
_____k. 

_____l. 

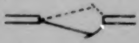
_____m. 

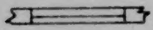
_____n. 

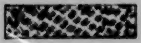
1. Wood (rough)
2. Wood (finished)
3. Brick
4. Firebrick
5. Concrete
6. Sand, plaster, cement, gypsum board
7. Arch--Cased opening
8. Gravel
9. Insulation
10. Flashing, termite barrier, waterproofing
11. Inside door
12. Casement window
13. Double-hung window
14. Structural steel or iron

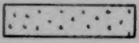
______o. 

______p.

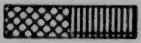
______q. 

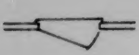
______r. 

______s. 

______t. 

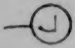
______u.

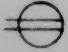
______v. 

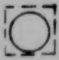
______w. 

15. Telephone jack
16. Glass (sheet and plate)
17. Tile--Hollow, terra-cotta
18. Earth
19. Floor drain
20. Cinders
21. Brick veneer
22. Outside door
23. Double-acting door

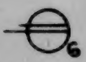
7. Match the names of the electrical symbols on the right to the correct symbols on the left.

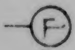
______a. 

______b. 

______c. 

______d.

______e. 

______f. 

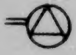
______g. S_P

1. Ceiling lighting outlet
2. Ceiling lighting outlet for recessed fixture
3. Duplex receptacle outlet
4. Junction box
5. Duplex grounding outlet
6. Switch and pilot lamp
7. Fan outlet

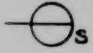
_____h. ■

_____i. S_{WP}

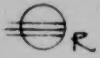
_____j. S_F

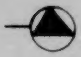
_____k. 

_____l. S_3

_____m. 

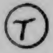
_____n. S

_____o. 

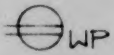
_____p. 

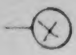
_____q. S_4

_____r. ▨

_____s. 

_____t. S_2

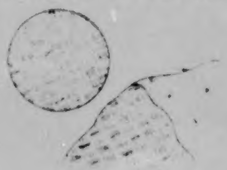
_____u. 

_____v. 

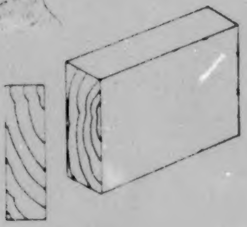
8. Switch and single receptacle
9. Power panel
10. Double pole switch
11. Three-way switch
12. Fused switch
13. Duplex special-purpose receptacle outlet
14. Lighting panel
15. Special purpose outlet
16. Four-way switch
17. Single pole switch
18. Weatherproof switch
19. Exit light outlet
20. Range outlet
21. Weatherproof outlet
22. Thermostat

8. Match the names of the sectioning symbols on the right to the correct symbols on the left.

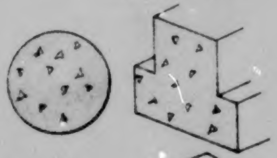
_____a.



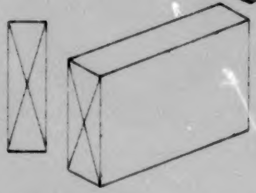
_____b.



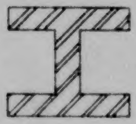
_____c.



_____d.



_____e.

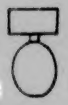


1. Finished lumber
2. Metal
3. Earth
4. Concrete
5. Rough lumber

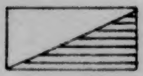
9. Match the names of the mechanical symbols on the right to the correct symbols on the left. An answer may be used more than once.

_____a. ——— G ——— G ———G

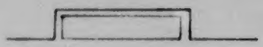
_____b.



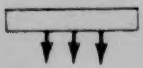
_____c.



_____d.

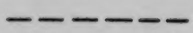


_____e.

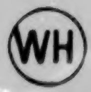


1. Gas--Low pressure
2. Exhaust, return, or outside air duct section
3. Water closet
4. Linear diffuser
5. Recessed radiator

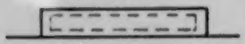
_____ f.



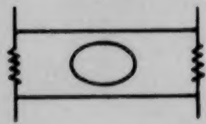
_____ g.



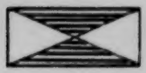
_____ h.



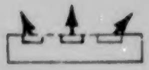
_____ i.



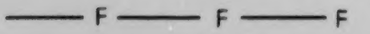
_____ j.



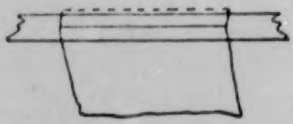
_____ k.



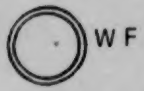
_____ l.



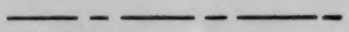
_____ m.



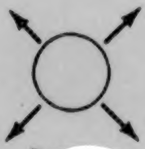
_____ n.



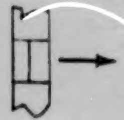
_____ o.



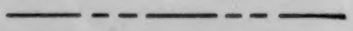
_____ p.



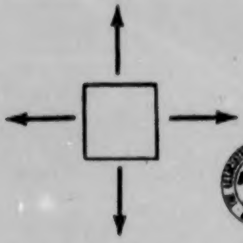
_____ q.



_____ r.

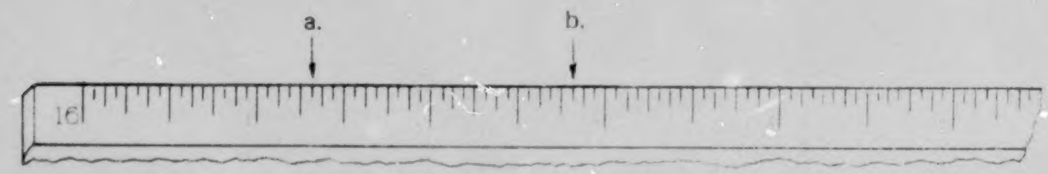


_____ s.



6. Enclosed radiator
7. Unit heater
8. Louver opening
9. Intake louvers
10. Water heater
11. Supply outlet; ceiling diffuser
12. Wash fountain
13. Lavatory
14. Cold water
15. Hot water
16. Fire line
17. Supply duct section
18. Vent

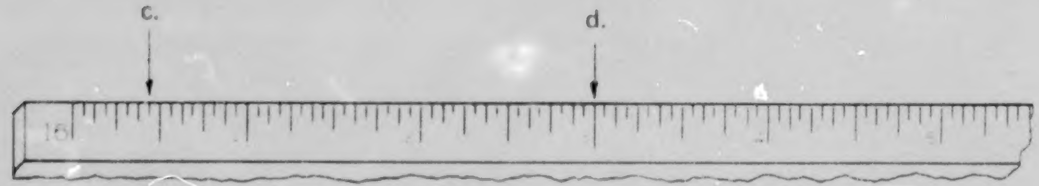
10. Read the measurements on the architect's scales below. Use the scales given. Write your answers in the blanks corresponding to the letters above the scales.



Full Scale 12" = 1'-0"

a. ____________

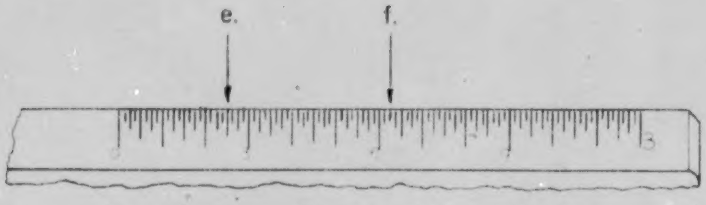
b. ____________



Half Scale 6" = 1'-0"

c. ____________

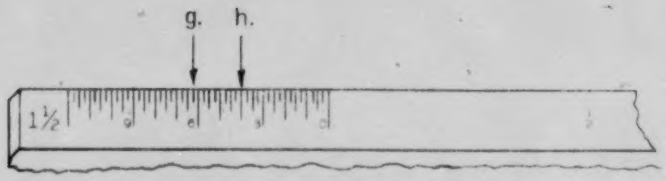
d. ____________



One-Fourth Scale 3" = 1'-0"

e. ____________

f. ____________

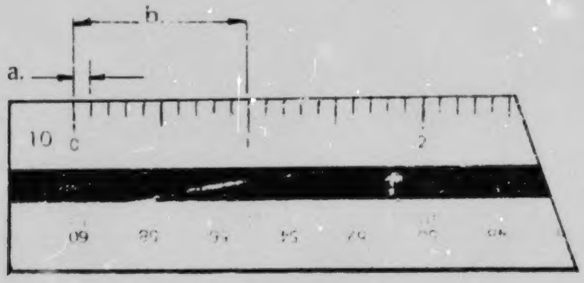


One-Eighth Scale 1½" = 1'-0"

g. ____________

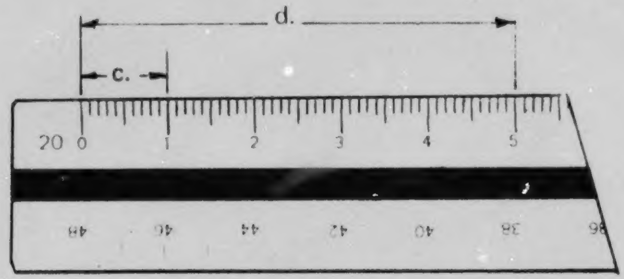
h. ____________

11. Read the following measurements on the engineer's scales below. Use the scales given. Write your answers in the blanks that correspond to the letters above the scales.


b.
a.
10
0
2
60
58
56
54
52
50
48

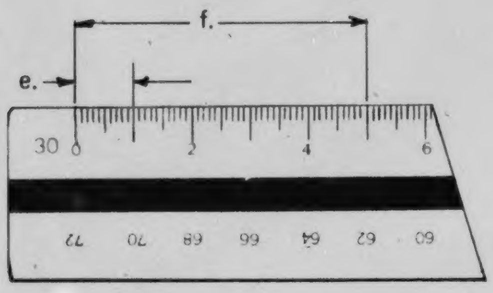
a. ____________________

b. ____________________


d.
c.
20
0
1
2
3
4
5
48
46
44
42
40
38
36

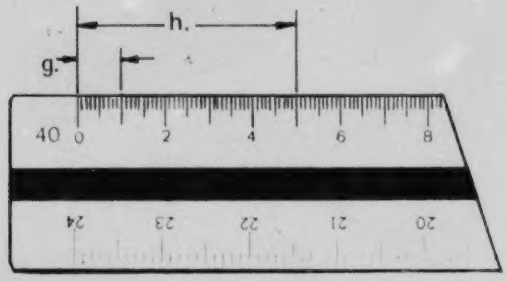
c. ____________________

d. ____________________


f.
e.
30
0
2
4
6
72
70
68
66
64
62
60

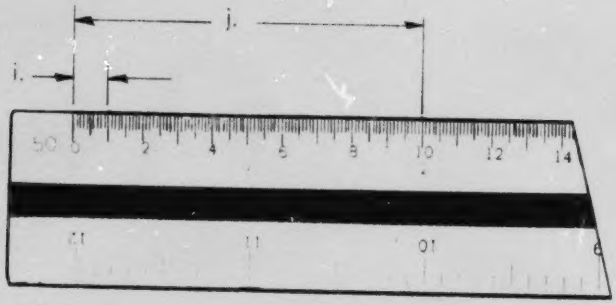
e. ____________________

f. ____________________


h.
g.
40
0
2
4
6
8
24
23
22
21
20

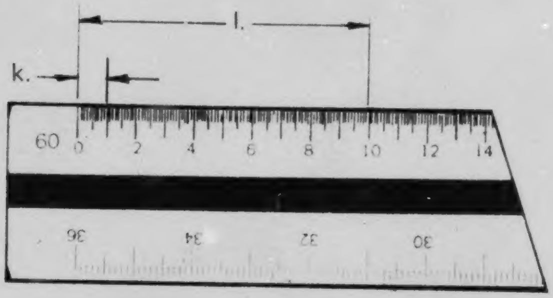
g. ____________________

h. ____________________


j.
i.
50
0
2
4
6
8
10
12
14
12
11
10
9

i. ____________

j. ____________


l.
k.
60
0
2
4
6
8
10
12
14
36
34
32
30

k. ____________

l. ____________

12. List major items that should be included in a set of specifications.

a. ____________

b. ____________

c. ____________

d. ____________

e. ____________

f. ____________

g. ____________

h. ____________

i. ____________

j. ____________

k. ____________

13. Extract the following information from the floor plan and schedules attached on the following pages.

    a. Front entrance door specifications

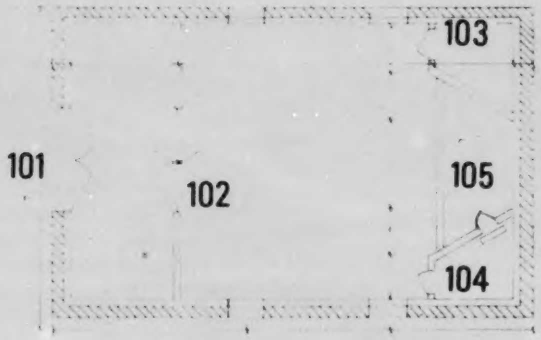
        1) Size
        2) Material
        3) Design
        4) Hardware
        5) Head
        6) Jamb
        7) Sill
        8) Remarks

    b. Hardware by set number

        1) Set 1
            a)
            b)
            c)
            d)
        2) Set 2
            a)
            b)
            c)
            d)
            e)
            f)
        3) Set 3
            a)
            b)
            c)

Door Schedule

No.	Size	Material	Design	Hardware	Head	Jamb	Sill	Remarks
101	3070×1¾ Pr	Oak	A	2	3/9	4/9	10/9	Threshold
102	3070×1¾ Pr	Oak	A	1	3/9	4/9	11/9	
103	2668×1½	Oak	B	3	3/9	4/9	11/9	
104	2668×1½	Oak	B	3	3/9	4/9	12/9	
105	2068×1½	Oak	B	3	3/9	4/9	12/9	



Door Schedule

Door No.	Hardware Set	Owners Number
101	2	1
102	1	2
103	3	3
104	3	4
105	3	5

Set 1	Pr of D.A. Vestibule to Chapel	
2 Pr	Spring Hinges	3029– USP–8
1	Exten. Flush Bolt	C457B10×12
4	Floor Stops	446B10
4	Push Plates	39–6X16–US10

Set 2	Pr Exterior to Vestibule	
3 Pr	Butts	BB1193–US10–4½×4½ NRP
2	Door Closers	C–RA–X–DB
2	Exit Device	8827 × 8858EO × US10
1	Threshold	3151-A
1 Set	Weather Strip	332 AR (Lip & Sides)
1 Pr	Astragel	305 BN

Set 3	Storage to Chapel	
1½ Pr	Butts	1279–US10–4×4
1	Lockset	HCE–131DL×US10
1	Door Closer	C–RA×DB

Hardware Schedule

BLUEPRINT READING
UNIT I

ANSWERS TO TEST

1. a. 5
   b. 3
   c. 6
   d. 7
   e. 8
   f. 2
   g. 4
   h. 1
   i. 11
   j. 10
   k. 9
   l. 12
   m. 13
   n. 14
   o. 15
   p. 16
   q. 19
   r. 20
   s. 17
   t. 18

2. a. Detail
   b. Elevation
   c. Floor plan
   d. Plot plan
   e. Foundation plan

3. a. P
   b. FO
   c. FL
   d. E
   e. P
   f. P
   g. D
   h. FL
   i. D
   j. P
   k. D
   l. FL
   m. D
   n. P

4. a. Object line
   b. Dimension line
   c. Extension line
   d. Hidden line
   e. Center line
   f. Section line (cutting plane)
   g. Break line, long
   h. Break line, short
   i. Phantom line
   j. Leader
   k. Fixture line
   l. Section lining

5. a. 8
   b. 5
   c. 6
   d. 12
   e. 9
   f. 10
   g. 2
   h. 7
   i. 11
   j. 4
   k. 1
   l. 3

6. a. 5
   b. 1
   c. 4
   d. 3
   e. 6
   f. 2
   g. 14
   h. 8
   i. 12
   j. 13

k. 10
l. 9
m. 11
n. 7
o. 21
p. 19
q. 23
r. 16
s. 18
t. 20
u. 15
v. 17
w. 22

7. a. 4
b. 3
c. 2
d. 1
e. 5
f. 7
g. 6
h. 14
i. 18
j. 12
k. 13
l. 11
m. 8
n. 17

o. 20
p. 15
q. 16
r. 9
s. 22
t. 10
u. 21
v. 19

8. a. 3
b. 1
c. 4
d. 5
e. 2

9. a. 1
b. 3
c. 2
d. 5
e. 4
f. 18
g. 10
h. 6
i. 13
j. 17
k. 7
l. 16
m. 9
n. 12
o. 14
p. 11
q. 8
r. 15
s. 11

10. a. 1 5/16"
    b. 2 13/16"
    c. 7/8"
    d. 6"
    e. 2 1/2"
    f. 6 1/4"
    g. 6 1/4"
    h. 4"

11. a. 0.1' or 1.0' or 10.0'
    b. 1.0' or 10.0' or 100.0'
    c. 10.0'
    d. 50.0'
    e. 10.0'
    f. 50.0'
    g. 10.0'
    h. 50.0'
    i. 10.0'
    j. 100.0'
    k. 10.0'
    l. 100.0'

12. a. Sizes
    b. Types and quality of building materials
    c. Methods of construction
    d. General requirements
    e. Owner's name and address
    f. Architect's name
    g. Location of new structure
    h. Completion date

i. Contractor's bid form

j. Guarantees

k. Insurance requirements

13. a. 1) Size--3070 x 1 3/4" pr.

2) Material--Oak

3) Design--A

4) Hardware--2

5) Head--3/9

6) Jamb--4/9

7) Sill-10/9

8) Remarks--Threshold

b\. 1) Set 1

a)	2 pr.	Spring hinges	3029 - USP - 8
b)	1	Exten. flush bolt	C457B10 x 12
c)	4	Floor stops	446B10
d)	4	Push plates	39 - 6 x 16 - US10

2) Set 2

a)	3 pr.	Butts	BB1193 - US10 - 4 1/2 x 4 1/2 NRP
b)	2	Door closers	C - RA - X - DB
c)	2 sets	Exit devices	8827 x 8858EO x US10
d)	1	Threshold	3151 - A
e)	1 set	Weather strip	332 AR (lip and sides)
f)	1 pr.	Astragel	305 BN

3) Set 3

a)	1 1/2 pr.	Butts	1279 - US10 - 4 x 4
b)	1	Lockset	HCE - 131DL x US10
c)	1	Door closer	C - RA x DB

ADVANCED BLUEPRINT READING
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to match common abbreviations to their meanings and list architectural conventions. The student should be able to list parts of a contract document and explain the difference between nominal and actual dimensions. The student should also be able to list the common schedules and types of symbols used in construction. This knowledge will be evidenced by completion of the assignment sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with advanced blueprint reading to the correct definitions.
2. List common shapes of surfaces and solids found in a set of plans.
3. List methods of illustrating an object or structure by a drawing.
4. Match common abbreviations used on plan views to their meanings.
5. List conventions used by architects.
6. List parts of a contract document.
7. Explain in a few words the relationship between drawings and specifications.
8. Explain the difference between nominal and actual dimensions.
9. List schedules commonly used by architects.
10. Define *contour lines*.
11. List standard types of symbols used in construction.

ADVANCED BLUEPRINT READING
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and assignment sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Provide students with a set of plans for them to use to become familiar with the symbols and schedules.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Surfaces and Solids

      2. TM 2--Perspectives

      3. TM 3--Isometric Views

      4. TM 4--Architectural Elevations

      5. TM 5--Conventions

      6. TM 6--Conventions (Continued)

      7. TM 7--Schedules

      8. TM 8--Schedules (Continued)

      9. TM 9--Schedules (Continued)

10. TM 10--Schedules (Continued)
11. TM 11--Architectural Symbols
12. TM 12--Architectural Symbols (Continued)
13. TM 13--Architectural Symbols (Continued)
14. TM 14--Architectural Symbols (Continued)
15. TM 15--Electrical Symbols: General Outlets
16. TM 16--Electrical Symbols: Convenience Outlets
17. TM 17--Electrical Symbols: Switch Outlets
18. TM 18--Electrical Symbols: Special Outlets
19. TM 19--Electrical Symbols: Panels, Circuits, and Miscellaneous
20. TM 20--Electrical Symbols: Auxiliary Systems
21. TM 21--Mechanical Symbols
22. TM 22--Mechanical Symbols (Continued)
23. TM 23--Mechanical Symbols (Continued)
24. TM 24--Mechanical Symbols (Continued)
25. TM 25--Mechanical Symbols (Continued)
26. TM 26--Mechanical Symbols (Continued)
27. TM 27--Mechanical Symbols (Continued)
28. TM 28--Mechanical Symbols (Continued)
29. TM 29--Mechanical Symbols (Continued)
30. TM 30--Mechanical Symbols (Continued)
31. TM 31--Mechanical Symbols (Continued)
32. TM 32--Mechanical Symbols (Continued)
33. TM 33--Mechanical Symbols (Continued)
34. TM 34--Mechanical Symbols (Continued)
35. TM 35--Mechanical Symbols (Continued)

    36. TM 36--Mechanical Symbols (Continued)
    37. TM 37--Mechanical Symbols (Continued)
    38. TM 38--Mechanical Symbols (Continued)
    39. TM 39--Topography Symbols
    40. TM 40--Topography Symbols (Continued)
    41. TM 41--Topography Symbols (Continued)
    42. TM 42--Topography Symbols (Continued)
    43. TM 43--Topography Symbols (Continued)
    44. TM 44--Topography Symbols (Continued)
    45. TM 45--Topography Symbols (Continued)
    46. TM 46--Site Survey
    47. TM 47--Topographic Map

  D. Assignment sheets
    1. Assignment Sheet #1--Identify Architectural Elevations
    2. Assignment Sheet #2--Identify Architectural Schedules
    3. Assignment Sheet #3--Identify Lines and Symbols
    4. Assignment Sheet #4--Identify Mechanical Symbols
    5. Assignment Sheet #5--Identify Electrical Symbols
    6. Assignment Sheet #6--Identify Topographic Symbols

  E. Answers to assignment sheets

  F. Test

  G. Answers to test

III. Unit references:

  A. Ramsey, Charles George, and Sleeper, Harold Reeve. *Architectural Graphic Standards.* New York: John Wiley and Sons, Inc., 1951.

  B. Ulrey, Harry F. *Carpenters and Builders Library: Builders Math, Plans, Specifications.* 3rd ed. Indianapolis, Indiana: Theodore Audel and Co./ Howard Sams and Co., Inc., 1972.

C. Hepler, Donald E., and Wallach, Paul I. *Architectural Drafting and Design.* New York: McGraw-Hill Book Company, 1971.

D. Kenney, Joseph E. *Blueprint Reading for the Building Trades.* New York: McGraw-Hill Book Company, 1955.

E. Bellis, Herbert F., and Schmidt, Walter A. *Blueprint Reading for the Construction Trades.* New York: McGraw-Hill Book Company, 1968.

ADVANCED BLUEPRINT READING
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Square--Having four equal sides and four right angles

B. Rectangle--Having four sides and four right angles with two sides being equal and longer than the other two sides which are also equal

C. Right triangle--Triangle having a right angle

D. Circle--Closed plane curve every point of which is of equal distance from the exact center

E. Prism--Form, either solid or void, with the top and bottom being equal and parallel to each other and the sides being parallelograms

(NOTE: A parallelogram is a figure whose opposite sides are parallel.)

F. Symbol--Arbitrary sign that has been standardized and is used to represent an object, quality, or method; pictorial way of showing conventional facts used in the construction trades

G. Conventions--Standardized methods by which architects show given facts

H. Specifications--Written, detailed descriptions that cover all features of work to be done, materials to use, method of installation, and quality of work that are not shown on drawings

I. Schedules--Systematic methods of presenting information and notes

J. Abbreviation--Shortened form of a word or phrase

K. Solids--Geometrical figures or elements having three dimensions, such as cube or sphere

L. Contract document--Written agreement between an owner, builder, architect, and/or engineer defining the responsibilities of each to the other

M. Perspective view--View showing exactly what you see when looking at an object or structure; resembles a photograph

N. Isometric projections--System of drawing with measurements on an equal scale in every one of three sets of lines 120° apart and representing the three planes of the dimensions

O. Dimensions--Arrangement of lines and symbols to indicate the actual size for constructing the object or structure that is represented

INFORMATION SHEET

P. Contract--Written agreement between two or more persons or parties

Q. Blueprints--Copy of the original detailed drawing

R. Topography--Map or drawing showing the configuration of a surface, including its relief and the location of its natural and constructed features (Transparencies 46 and 47)

II. Common shapes of surfaces and solids found in a set of plans (Transparency 1)

A. Square

B. Rectangle

C. Right triangle

D. Square and rectangle

E. Square and triangle

F. Solid square

G. Solid rectangle

H. Circle

I. Prism

J. Combinations

III. Methods of illustrating an object or structure by a drawing (Transparencies 2-4)

A. Perspectives

B. Isometric views

C. Development of surfaces

D. Architectural elevations (Assignment Sheet #1)

E. Topographic layouts

INFORMATION SHEET

IV. Common abbreviations used on plan views

Access Panel	AP
Acoustic	ACST
Acoustical Tile	AT
Aggregate	AGGR
Air Conditioning	AIR COND
Aluminum	AL
Anchor Bolt	AB
Angle	∠
Apartment	APT
Approximate	APPROX
Architectural	ARCH
Area	A
Area Drain	AD
Asbestos	ASB
Asbestos Board	AB
Asphalt	ASPH
Asphalt Tile	AT
Basement	BSMT
Bathroom	B
Bathtub	BT
Beam	BM
Bearing Plate	BRG PL
Bedroom	BR
Blocking	BLKG
Blueprint	BP
Boiler	BLR
Book Shelves	BK SH
Brass	BRS
Brick	BRK
Bronze	BRZ
Broom Closet	BC
Building	BLDG
Building Line	BL
Cabinet	CAB
Calking	CLKG
Casing	CSG
Cast Iron	CI
Cast Stone	CS
Catch Basin	CB
Cellar	CEL
Cement	CEM
Cement Asbestos Board	CEM AB
Cement Floor	CEM FL
Cement Mortar	CEM MORT
Center	CTR
Center to Center	C to C
Center Line	℄ or CL
Center Matched	CM
Ceramic	CER
Channel	CHAN
Cinder Block	CIN BL
Circuit Breaker	CIR BKR
Cleanout	CO
Cleanout Door	COD
Clear Glass	CL GL
Closet	C, CL, or CLO
Cold Air	CA
Cold Water	CW
Collar Beam	COL B
Concrete	CONC
Concrete Block	CONC B
Concrete Floor	CONC FL
Conduit	CND
Construction	CONST
Contract	CONT
Copper	COP
Counter	CTR
Cubic Feet	CU FT
Cut Out	CO
Detail	DET
Diagram	DIAG
Dimension	DIM
Dining Room	DR
Dishwasher	DW
Ditto	DO
Double-Acting	DA
Double Strength Glass	DSG
Down	DN
Downspout	DS
Drain	D or DR
Drawing	DWG
Dressed and Matched	D & M
Dryer	D
Electric Panel	EP
End to End	E to E
Excavate	EXC
Expansion Joint	EXP JT
Exterior	EXT
Finish	FIN
Finished Floor	FIN FL
Firebrick	FBRK
Fireplace	FP
Fireproof	FPRF
Fixture	FIX
Flashing	FL
Floor	FL

INFORMATION SHEET

Floor Drain	FD
Flooring	FLG
Fluorescent	FLUOR
Flush	FL
Footing	FTG
Foundation	FND
Frame	FR
Full Size	FS
Furring	FUR
Galvanized Iron	GI
Garage	GAR
Gas	G
Glass	GL
Glass Block	GL BL
Grille	G
Gypsum	GYP
Hardware	HDW
Hollow Metal Door	HMD
Hose Bib	HB
Hot Air	HA
Hot Water	HW
Hot Water Heater	HWH
I Beam	I
Inside Diameter	ID
Insulation	INS
Interior	INT
Iron	I
Jamb	JB
Kitchen	K
Landing	LDG
Lath	LTH
Laundry	LAU
Laundry Tray	LT
Lavatory	LAV
Leader	L
Length	L, LG, or LNG
Library	LIB
Light	LT
Limestone	LS
Linen Closet	L CL
Lining	LN
Linoleum	LINO
Living Room	LR
Louver	LV
Main	MN
Marble	MR
Masonry Opening	MO
Material	MATL
Maximum	MAX
Medicine Cabinet	MC
Minimum	MIN
Miscellaneous	MISC
Mixture	MIX
Modular	MOD
Mortar	MOR
Moulding	MLDG
Nosing	NOS
Obscure Glass	OBSC GL
On Center	OC
Opening	OPNG
Outlet	OUT
Overall	OA
Overhead	OVHD
Pantry	PAN
Partition	PTN
Plaster	PL or PLAS
Plastered Opening	PO
Plate	PL
Plate Glass	PL GL
Platform	PLAT
Plumbing	PLBG
Porch	P
Precast	PRCST
Prefabricated	PREFAB
Pull Switch	PS
Quarry Tile Floor	QTF
Radiator	RAD
Random	RDM
Range	R
Recessed	REC
Refrigerator	REF
Register	REG
Reinforce or Reinforcing	REINF
Revision	REV
Riser	R
Roof	RF
Roof Drain	RD
Room	RM or R
Rough	RGH
Rough Opening	RGH OPNG
Rubber Tile	R TILE
Scale	SC
Schedule	SCH
Screen	SCR
Scuttle	S
Section	SECT
Select	SEL
Service	SERV
Sewer	SEW
Sheathing	SHTHG
Sheet	SH
Shelf and Rod	SH & RD
Shelving	SHELV
Shower	SH
Sill Cock	SC
Single Strength Glass	SSG
Sink	SK or S
Soil Pipe	SP
Specification	SPEC
Square Feet	SQ FT

INFORMATION SHEET

Stained	STN
Stairs	ST
Stairway	STWY
Standard	STD
Steel	ST or STL
Steel Sash	SS
Storage	STG
Switch	SW or S
Telephone	TEL
Terra Cotta	TC
Terrazzo	TER
Thermostat	THERMO
Threshold	TH
Toilet	T
Tongue and Groove	T & G
Tread	TR or T
Typical	TYP
Unfinished	UNF
Unexcavated	UNEXC
Utility Room	URM
Vent	V
Vent Stack	VS
Vinyl Tile	V TILE
Warm Air	WA
Washing Machine	WM
Water	W
Water Closet	WC
Water Heater	WH
Waterproof	WP
Weather Stripping	WS
Weephole	WH
White Pine	WP
Wide Flange	WF
Wood	WD
Wood Frame	WF
Yellow Pine	YP

V. Conventions used by architects (Transparencies 5 and 6)

  A. Methods of dimensioning walls, doors, and windows in concrete

  B. Dimensioning exterior and interior walls

  C. Dimensioning doors and windows in solid brick walls

  D. Dimensioning doors and windows in brick-veneer and wood stud walls

  E. Dimensioning interior doors and alterations

  F. Dimensioning window elevations

VI. Parts of a contract document

  A. Contract

  (NOTE: This is usually made between the owner and contractor.)

  B. Blueprints

  (NOTE: On drawings and/or blueprints large scale usually takes preference over small scale.)

  C. Specifications

  (NOTE: Specifications take preference over blueprints.)

INFORMATION SHEET

VII. Relationship between drawings and specifications

A. Drawings furnish what the specifications cannot

B. Specifications furnish what the drawings cannot

(NOTE: Specifications are equally as important as the blueprints in as much as they give detailed and accurate descriptions of work to be done, including quantity and quality of material, method of construction, standards of construction, and manner of conducting the work.)

VIII. Difference between nominal and actual dimensions

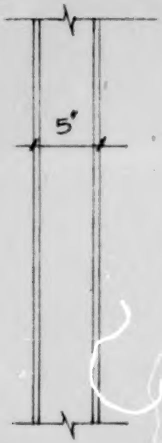
(NOTE: In some drawings dimensions are given as nominal and not actual. See Examples 1 and 2.)

A. Nominal dimensions are rough figures

B. Actual dimensions are exact figures

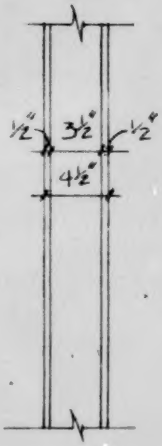
(NOTE: Sometimes dimensions are given from center of wall to center of wall instead of from edge of wall to edge of wall. See Example 3.)

Example 1:



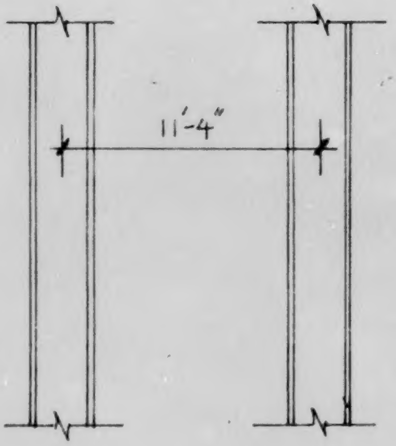
NOMINAL

Example 2:



ACTUAL

Example 3:



SCALE: 1"=1'-0"

INFORMATION SHEET

IX. Schedules commonly used by architects (Transparencies 7-10, Assignment Sheet #2)

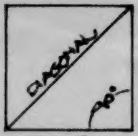
- A. Finish
- B. Window
- C. Door
- D. Structural elements
- E. Lintel

X. Contour lines--Lines connecting points which have the same elevation and indicate the topography of the plot (Transparencies 46 and 47)

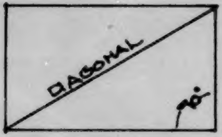
XI. Standard types of symbols used in construction (Transparencies 11-47, Assignment Sheets #3-#6)

- A. Architectural
- B. Electrical
- C. Mechanical
- D. Topographic

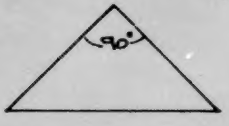
Surfaces and Solids


DIAGONAL
90°

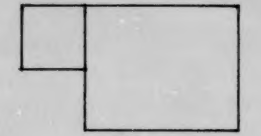
Square


DIAGONAL
90°

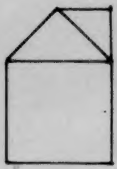
Rectangle



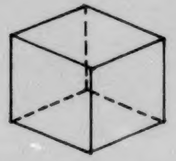
Right Triangle



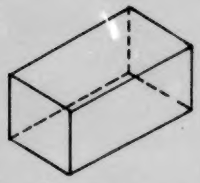
Square
and Rectangle



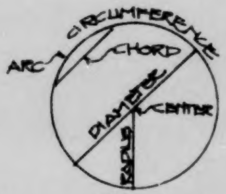
Square
and Triangle



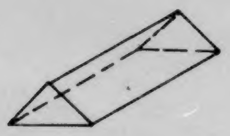
Solid Square



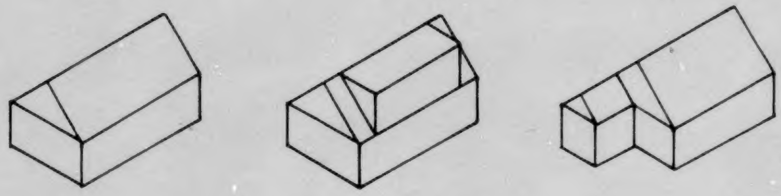
Solid Rectangle


CIRCUMFERENCE
ARC
CHORD
DIAMETER
CENTER
RADIUS

Circle

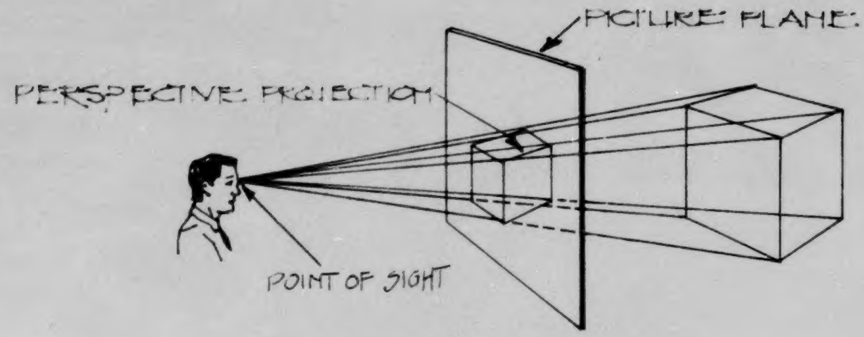


Prism

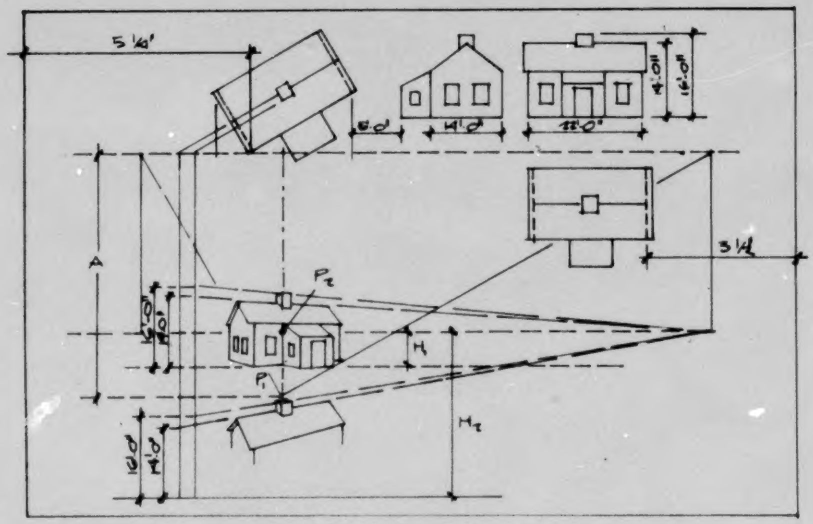


Combinations

Perspectives


PICTURE PLANE
PERSPECTIVE PROJECTION
POINT OF SIGHT

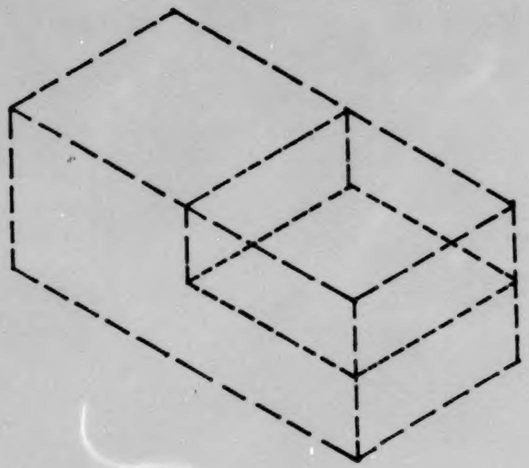
Picture Plane Illustrating Principles of Perspective Drawing

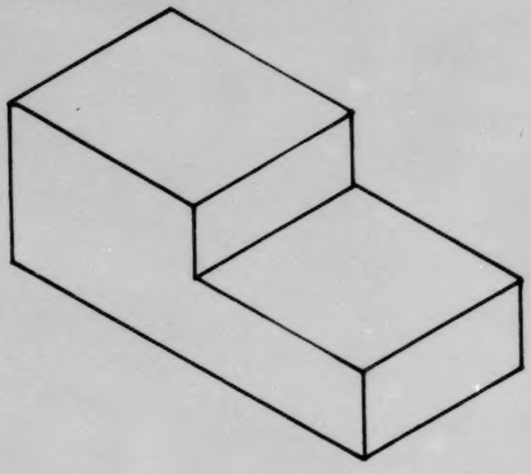

5 1/4'
6'0"
14'0"
22'0"
4'0"
16'0"
A
P_2
H_1
P_1
H_2
3 1/4
10'0"
4'0"

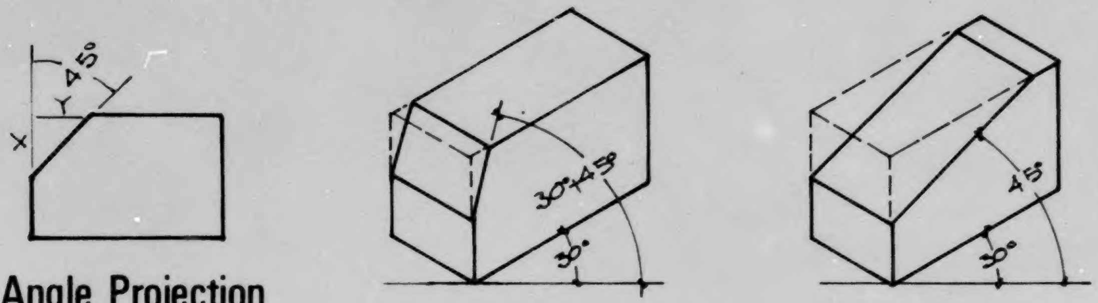
Perspective of a House

Reprinted by permission of Howard W. Sams and Co., Inc. from *Carpenters and Builders Library: Builders Math, Plans, Specifications* by Harry F. Ulrey, copyright 1972.

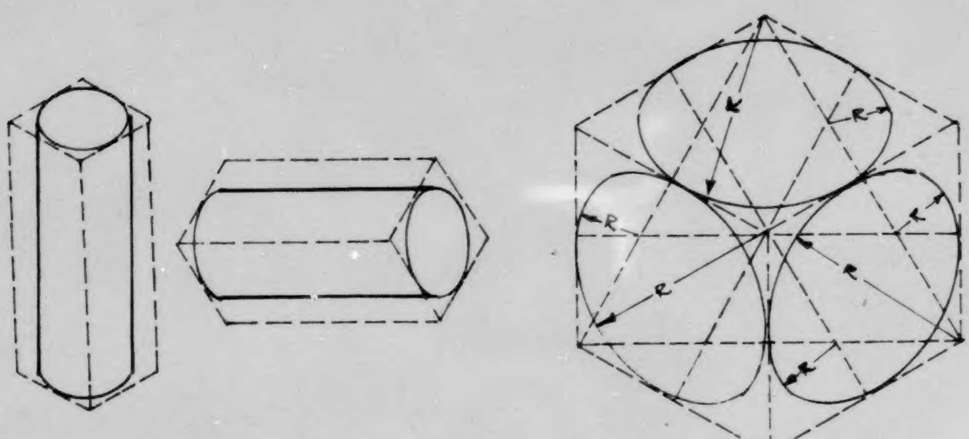
Isometric Views





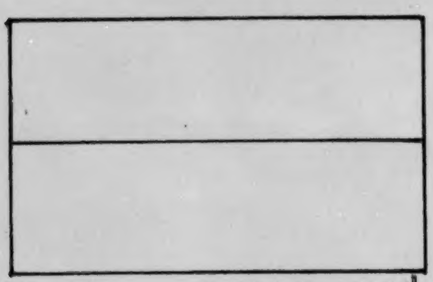

45°
X
30°+45°
30°
45°
30°

Angle Projection

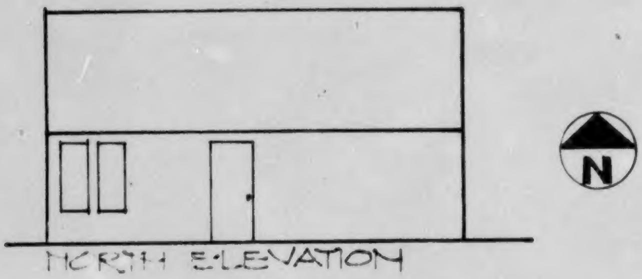


Isometric Cylinders and Ellipses

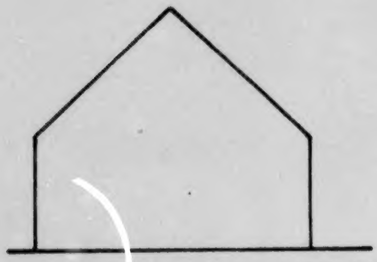
Architectural Elevations



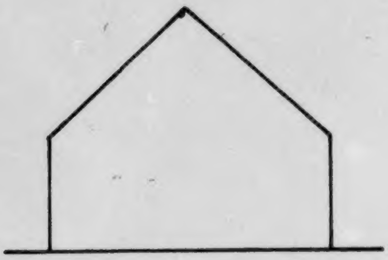
PLAN SCALE 3/32"=1'-0"



NORTH ELEVATION



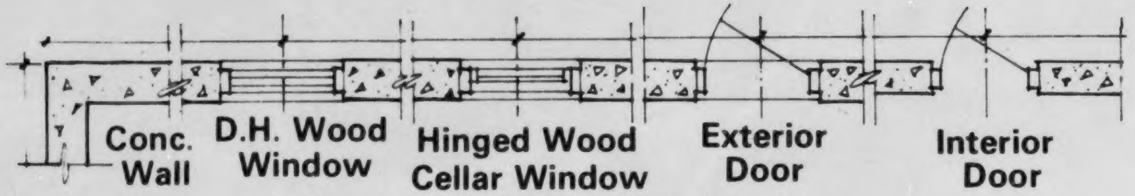
EAST ELEVATION



WEST ELEVATION

Conventions

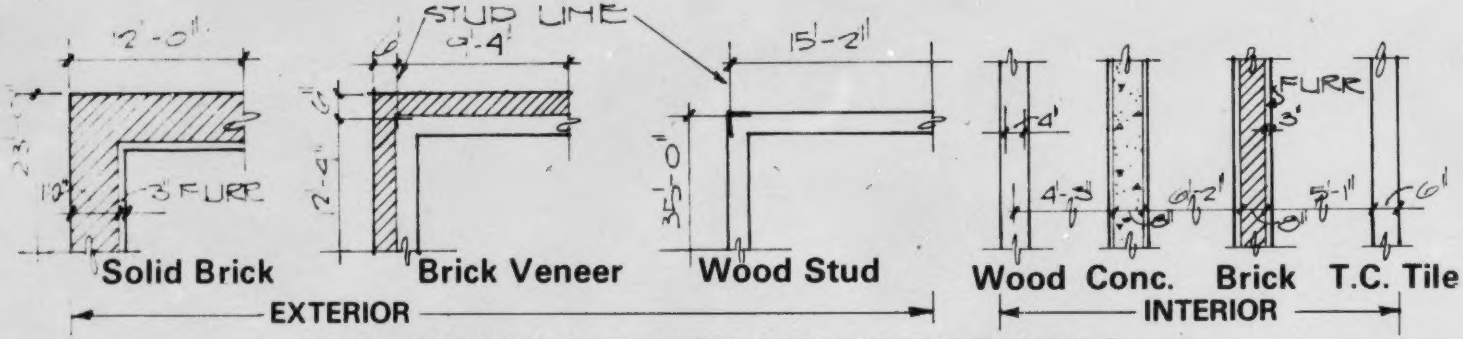
1



Conc. Wall
D.H. Wood Window
Hinged Wood Cellar Window
Exterior Door
Interior Door

CONCRETE WALL INDICATIONS

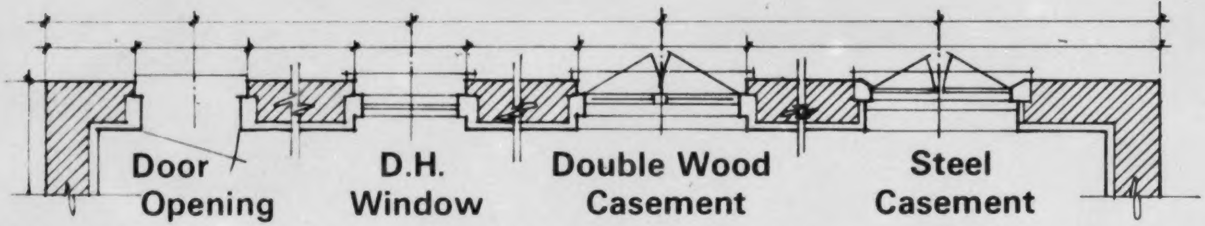
2



12'-0"
23'-0"
1'0"
3 FURR
STUD LINE
9'-4'
6"
12'-2"
15'-2"
35'-0"
4'
4'-3"
6'-2"
8"
FURR
3'
8"
5'-1"
6"
Solid Brick
Brick Veneer
Wood Stud
Wood
Conc.
Brick
T.C. Tile
EXTERIOR
INTERIOR

DIMENSIONING EXTERIOR AND INTERIOR WALLS

3

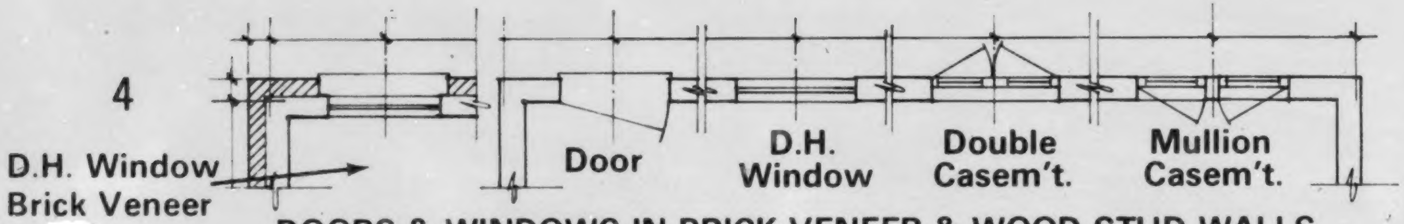


Door Opening
D.H. Window
Double Wood Casement
Steel Casement

DOORS AND WINDOWS IN SOLID BRICK WALL

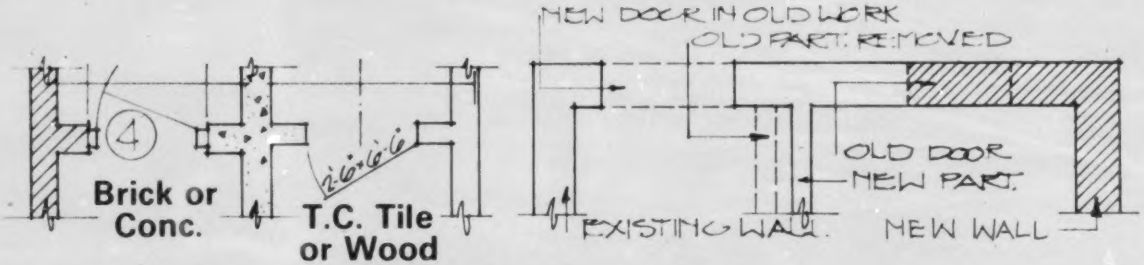
Conventions
(Continued)

4


D.H. Window
Brick Veneer
Door
D.H. Window
Double Casem't.
Mullion Casem't.

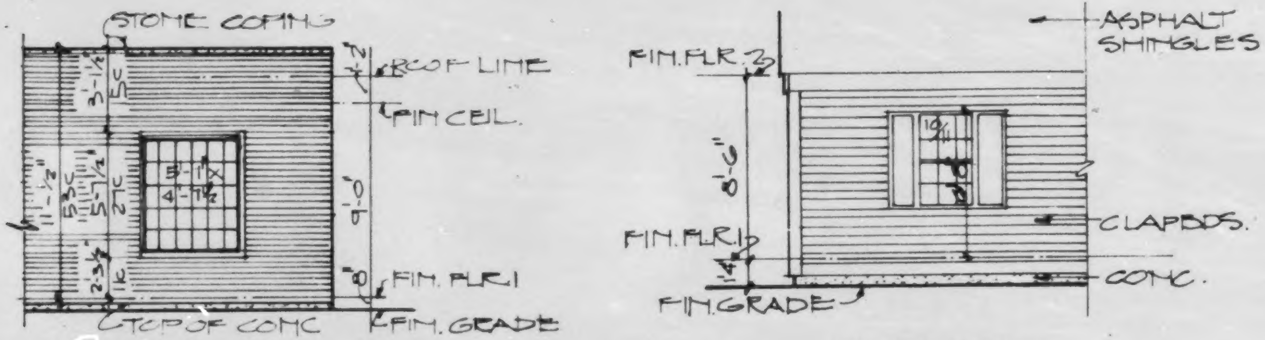
DOORS & WINDOWS IN BRICK VENEER & WOOD STUD WALLS

5


④
Brick or Conc.
2'-6"x6'-6"
T.C. Tile or Wood
NEW DOOR IN OLD WORK
OLD PART REMOVED
OLD DOOR
NEW PART
EXISTING WALL
NEW WALL

INTERIOR DOOR DIMENSIONS & ALTERATIONS

6


STONE COPING
ROOF LINE
FIN. CEIL.
3'-1½"
5C
11'-1½"
53C
5'-7¼"
27C
3'-1½" x 4'-7½"
2'-3½"
11C
9'-0"
8"
FIN. FLR. 1
TOP OF CONC.
FIN. GRADE
ASPHALT SHINGLES
FIN. FLR. 2
10½
8'-6"
CLAPBDS.
FIN. FLR. 1
1'-4"
CONC.
FIN. GRADE

BRICK WALL

WOOD WALL

WINDOW ELEVATIONS

Schedules

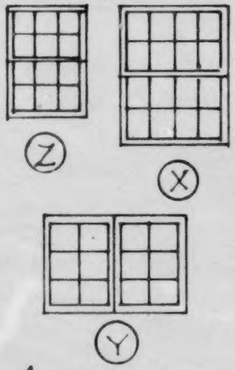
FINISH SCHEDULE

ROOM	WALLS	DADO	BASE	FLOOR	CEILING	CORNICE	REMARKS
LIV. RM.	PLASTER	CANVAS	WOOD	OAK	PLASTER	WOOD	BOOKCASE
DIN. RM	"	"	"	"	"	PICT. MLDG	CUPBD.
KITCHEN	"	4'-0" TILE	TILE	LINOLEUM	"	—	—
HALL	"	—	WOOD	OAK	'	WOOD	SEE DTL.
ENTRY	"	—	'	"	"	—	—

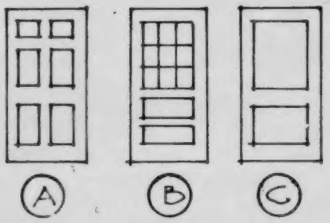
Schedules

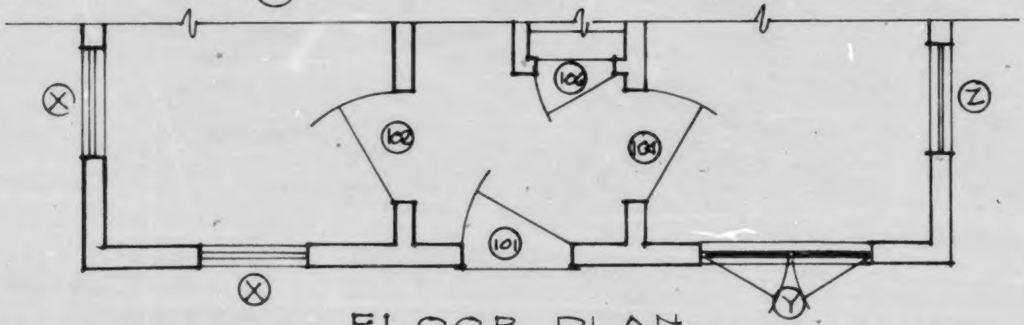
(Continued)

WINDOW SCHEDULE:		
TYPE	SIZE	REMARKS
X	2'6"×4'-1"	D.HUNG
Y	3'0"×4'0"	CASEMENT
Z	2'-3"×3'-1"	D.HUNG



DOOR SCHEDULE			
NO.	TYPE	SIZE	REMARKS
101	A	2'8"×6'8"×1 3/4"	DETAIL
102	C	2'6"×6'6"×1 3/8"	STOCK
103	B	2'6"×6'8"×1 3/4	GLAZED
104	C	2'6"×6'6"×1 3/8"	STOCK
105	C	" " "	"
106	C	2'4"× " "	"





FLOOR PLAN

Schedules

(Continued)

CONCRETE BEAM SCHEDULE

	MARK	CONCRETE			REINFORCEMENT		STIRRUPS		REMARKS
		B	D	T	BOTTOM BARS	TOP BARS	SIZE	SPACING	
FIRST FLOOR	1B1	14"	24"	32"	A-4-1¼"	G-3-1" EA. END	3/8φ	1@3"-4@6"-3@9"-3@9"	
	1B1 A	14"	24"	23"	A-4-1"	G-2-1" "	3/8φ	1@3"-6@12"	
	1B2	14"	24"	36"	A-4-1¼"	G-4-1" "	1/2φ	1@3"-2@6"-3@9"	
	1B3	14"	24"	39"	A-5-1¼"	G-4-1" "	1/2φ	DO. 1B2	

Schedules

(Continued)

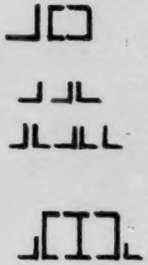
LINTEL SCHEDULE:

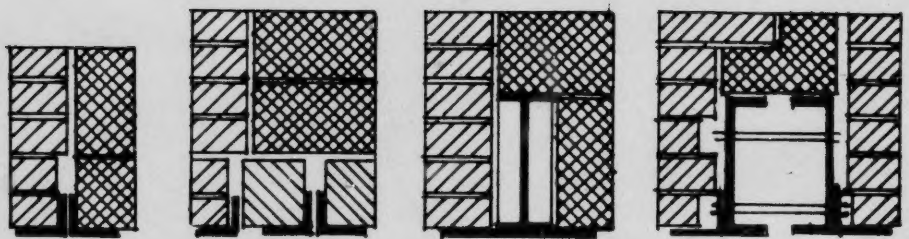
1L1 — { 1L 5"×5"×$\frac{3}{8}$" / 2-4" [s 5.4#

1L2 — 3Ls 3"×3"×$\frac{1}{4}$"

1L3 — 5Ls 3"×3"×$\frac{1}{4}$"

1L4 — { 1-7" I 5.3# / 2-7" [s 9.8# / 2-3×3×$\frac{1}{4}$" Ls





2L LINTEL 8" WALL

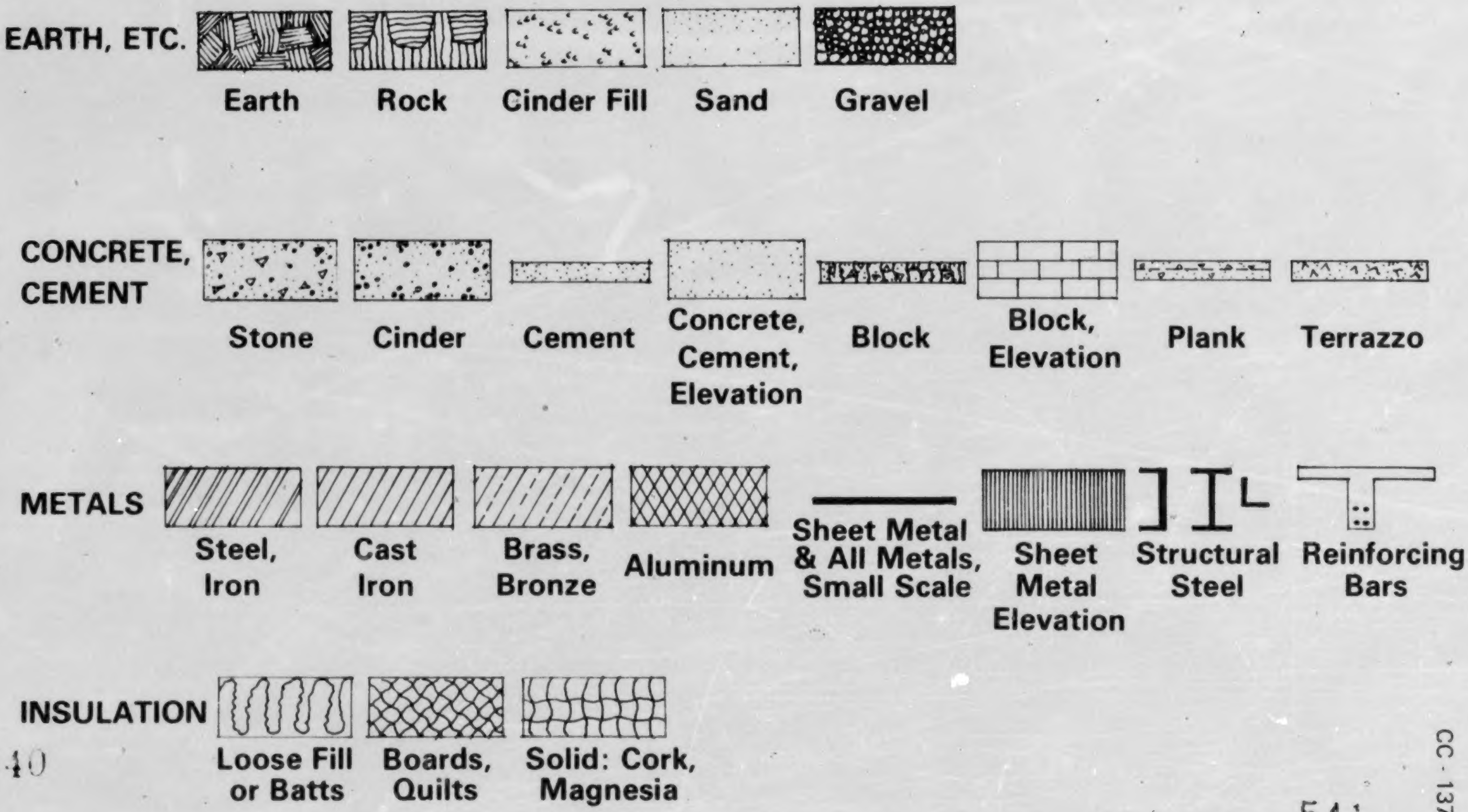
3L LINTEL 12" WALL

I BEAM & PLATE 12" WALL

CHANNELS & Ls 16" WALL

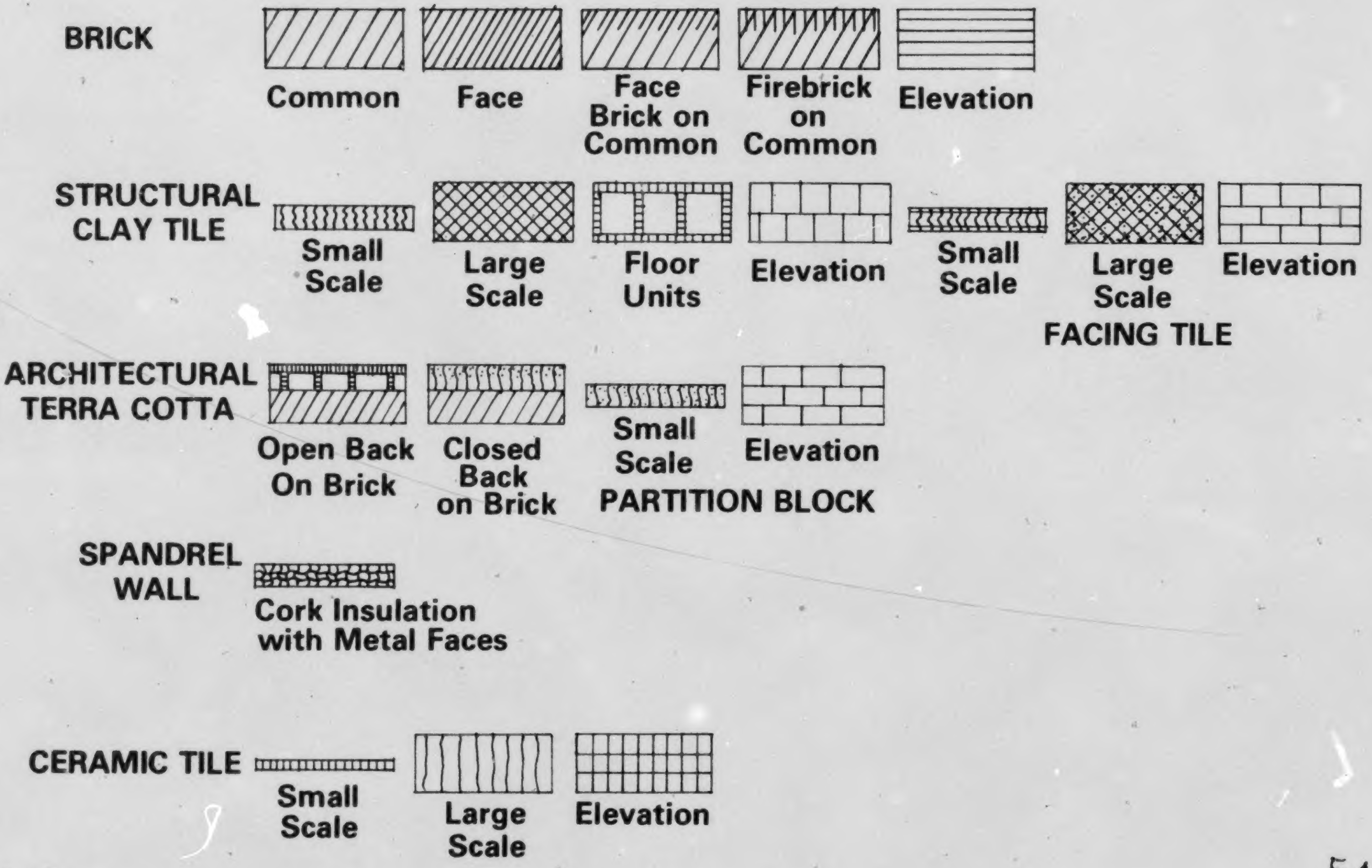
STRUCTURAL STEEL LINTELS

Architectural Symbols


EARTH, ETC.
Earth
Rock
Cinder Fill
Sand
Gravel
CONCRETE, CEMENT
Stone
Cinder
Cement
Concrete, Cement, Elevation
Block
Block, Elevation
Plank
Terrazzo
METALS
Steel, Iron
Cast Iron
Brass, Bronze
Aluminum
Sheet Metal & All Metals, Small Scale
Sheet Metal Elevation
Structural Steel
Reinforcing Bars
INSULATION
Loose Fill or Batts
Boards, Quilts
Solid: Cork, Magnesia

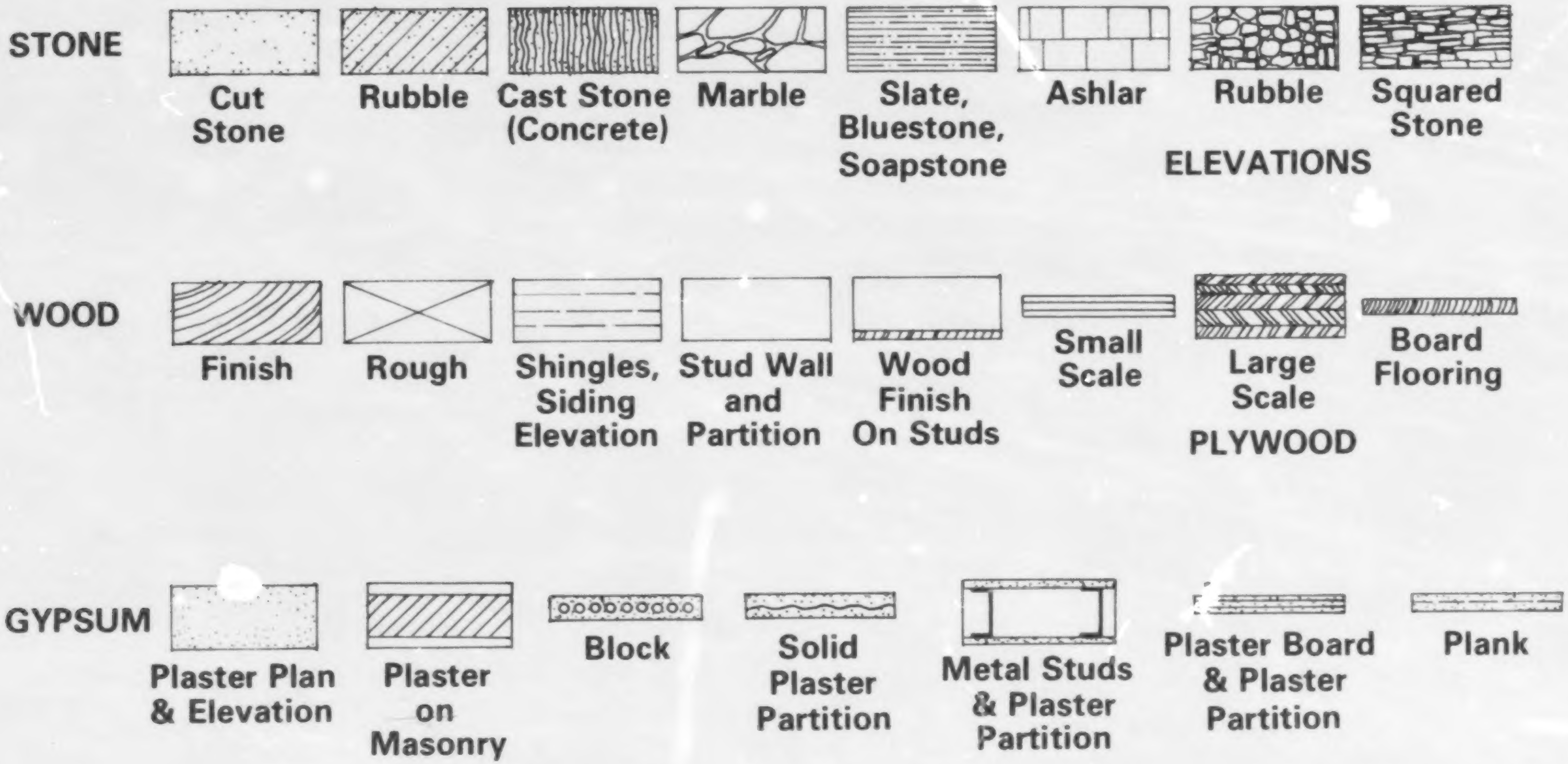
Architectural Symbols

(Continued)


BRICK
Common
Face
Face Brick on Common
Firebrick on Common
Elevation
STRUCTURAL CLAY TILE
Small Scale
Large Scale
Floor Units
Elevation
Small Scale
Large Scale
Elevation
FACING TILE
ARCHITECTURAL TERRA COTTA
Open Back On Brick
Closed Back on Brick
Small Scale
Elevation
PARTITION BLOCK
SPANDREL WALL
Cork Insulation with Metal Faces
CERAMIC TILE
Small Scale
Large Scale
Elevation

Architectural Symbols

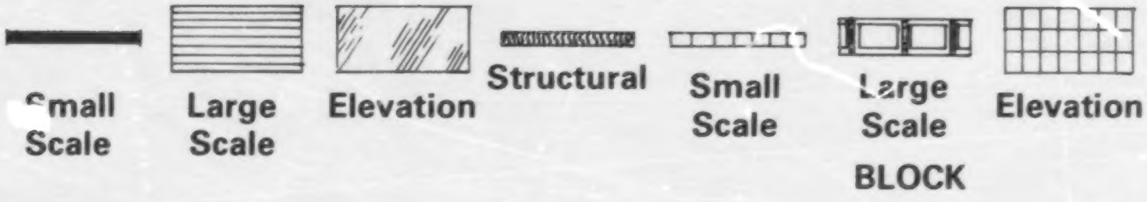
(Continued)


STONE
Cut Stone
Rubble
Cast Stone (Concrete)
Marble
Slate, Bluestone, Soapstone
Ashlar
Rubble
Squared Stone
ELEVATIONS
WOOD
Finish
Rough
Shingles, Siding Elevation
Stud Wall and Partition
Wood Finish On Studs
Small Scale
Large Scale
PLYWOOD
Board Flooring
GYPSUM
Plaster Plan & Elevation
Plaster on Masonry
Block
Solid Plaster Partition
Metal Studs & Plaster Partition
Plaster Board & Plaster Partition
Plank

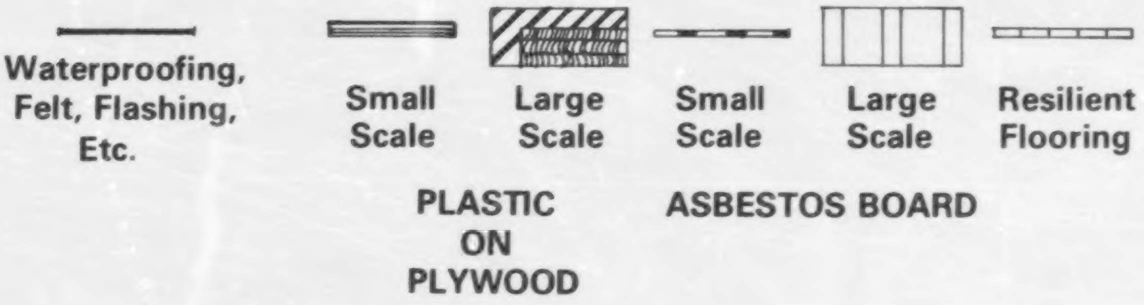
Architectural Symbols

(Continued)

GLASS

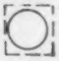
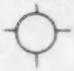
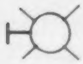

Small Scale
Large Scale
Elevation
Structural
Small Scale
Large Scale
Elevation
BLOCK

MISCELLANEOUS


Waterproofing, Felt, Flashing, Etc.
Small Scale
Large Scale
Small Scale
Large Scale
Resilient Flooring
PLASTIC ON PLYWOOD
ASBESTOS BOARD

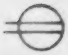
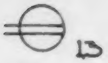
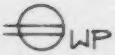
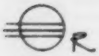
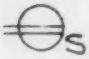
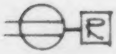
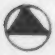
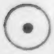
Electrical Symbols

GENERAL OUTLETS

Ceiling	Wall	
○	—○	**Outlet**
Ⓑ	—Ⓑ	**Blanked Outlet**
Ⓓ		**Drop Cord**
Ⓔ	—Ⓔ	**Electrical Outlet**
Ⓕ	—Ⓕ	**Fan Outlet**
Ⓙ	—Ⓙ	**Junction Box**
Ⓛ	—Ⓛ	**Lamp Holder**
Ⓛ$_{PS}$	—Ⓛ$_{PS}$	**Lamp Holder with Pull Switch**
Ⓢ	—Ⓢ	**Pull Switch**
Ⓥ	—Ⓥ	**Outlet for Vapor Discharge Lamp**
⊗	—⊗	**Exit Light Outlet**
Ⓒ	—Ⓒ	**Clock Outlet (Specify Voltage)**
	○	**Ceiling Light Outlet (recessed fixtures)**
		**Ceiling Light Fixture**

Electrical Symbols

CONVENIENCE OUTLETS

	Duplex Convenience Outlet
	Convenience Outlet other than Duplex 1=Single, 3=Triplex, etc.
	Weatherproof Convenience Outlet
	Range Outlet
	Switch and Convenience Outlet
	Radio and Convenience Outlet
	Special Purpose Outlet (Describe in Spec.)
	Floor Outlet

Electrical Symbols

SWITCH OUTLETS

S	Single Pole Switch
S_2	Double Pole Switch
S_3	Three Way Switch
S_4	Four Way Switch
S_D	Automatic Door Switch
S_E	Electrolier Switch
S_K	Key Operated Switch
S_P	Switch and Pilot Lamp
S_{CB}	Circuit Breaker
S_{WCB}	Weatherproof Circuit Breaker
S_{MC}	Momentary Contact Switch
S_{RC}	Remote Control Switch
S_{WP}	Weatherproof Switch
S_F	Fused Switch
S_{WF}	Weatherproof Fused Switch

Electrical Symbols

SPECIAL OUTLETS

○a,b,c etc.

=⊖a,b,c etc.

Sa,b,c etc.

Any Standard Symbol as given with the addition of a lower case subscript letter may be used to designate some special variation of Standard Equipment of particular interest in a specific set of Architectural Plans.

Electrical Symbols

PANELS, CIRCUITS & MISCELLANEOUS

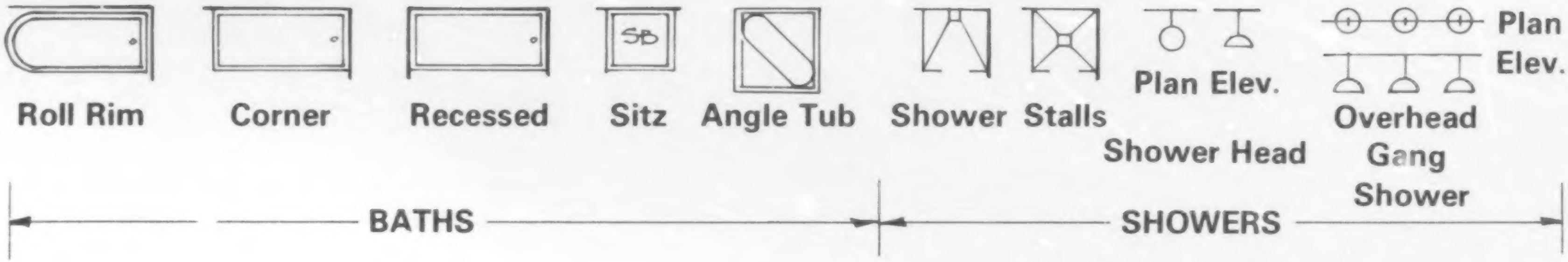
■	Lighting Panel
▨	Power Panel
——	Branch Circuit; Concealed in ceiling or wall
—·—	Branch Circuit; Concealed in floor
----	Branch Circuit; Exposed
→→	Home Run to Panel Board. Indicate number of Circuits by number of arrows.
━━	Feeders. Use heavy lines and designate by number corresponding to listing in Feeder Schedule.
≡☐≡	Under floor Duct and Junction Box. Triple System.
Ⓖ	Generator
Ⓜ	Motor
Ⓘ	Instrument
Ⓣ	Power Transformer. (Or draw to scale)
⊠	Controller
☐	Isolating Switch

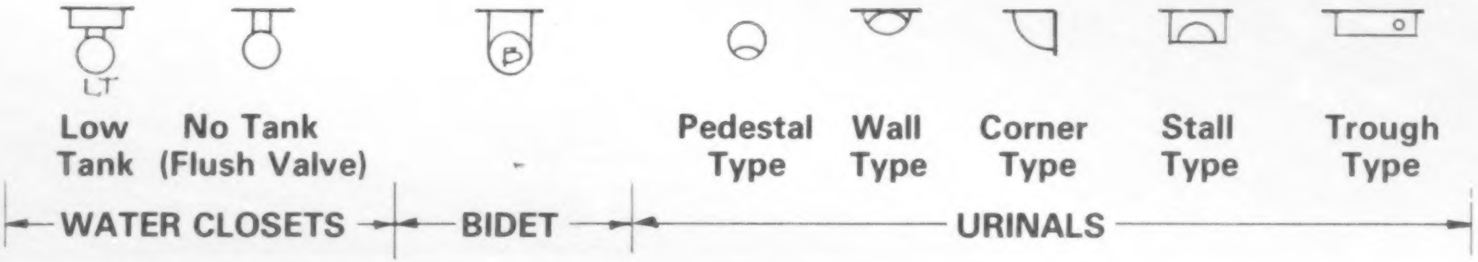
Electrical Symbols

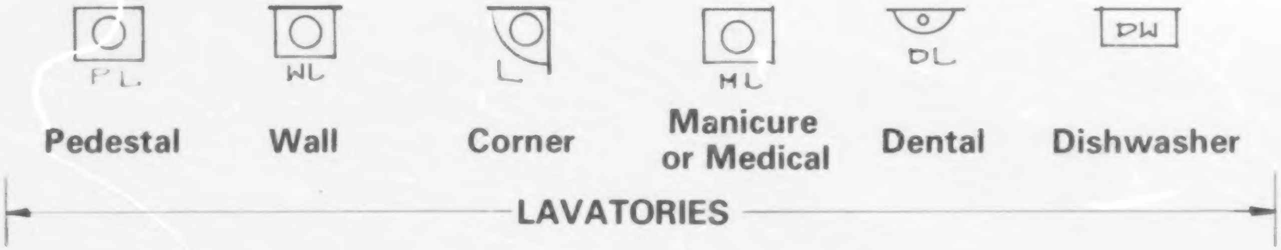
AUXILIARY SYSTEMS

⊡	Push Button
□↙	Buzzer
□○	Bell
—◇	Annunciator
◀	Outside Telephone
◁	Interconnecting Telephone
[◁	Telephone Switchboard
Ⓣ	Bell Ringing Transformer
D	Electric Door Opener
F○	Fire Alarm Bell
F	Fire Alarm Station
☒	City Fire Alarm Station
FA	Fire Alarm Central Station
FS	Automatic Fire Alarm Device
W	Watch's Station
[W]	Watch's Central Station
H	Horn
N	Nurse's Signal Plug
M	Maid's Signal Plug
R	Radio Outlet
[SC]	Signal Central Station
▭	Interconnection Box
|ı|ı|	Battery

Mechanical Symbols

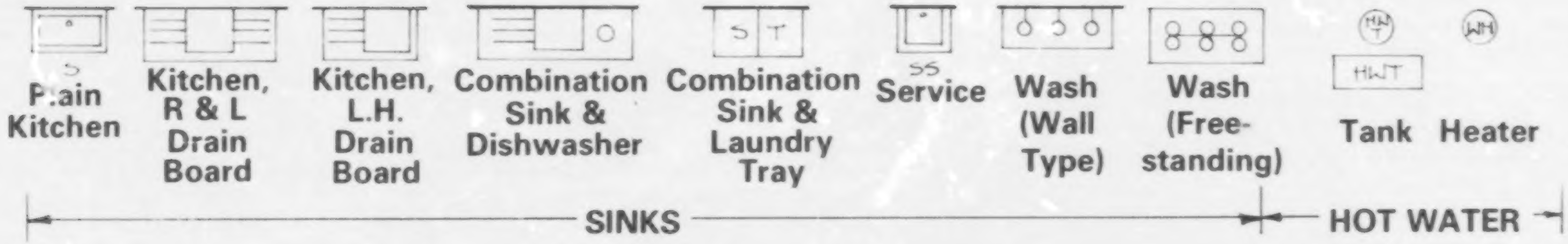

SB
Roll Rim
Corner
Recessed
Sitz
Angle Tub
Shower
Stalls
Plan Elev.
Shower Head
Plan
Elev.
Overhead
Gang
Shower
BATHS
SHOWERS

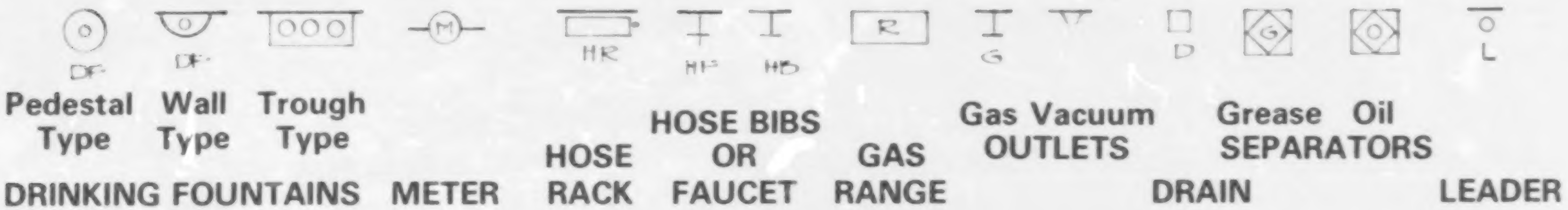

LT
B
Low
Tank
No Tank
(Flush Valve)
Pedestal
Type
Wall
Type
Corner
Type
Stall
Type
Trough
Type
WATER CLOSETS
BIDET
URINALS

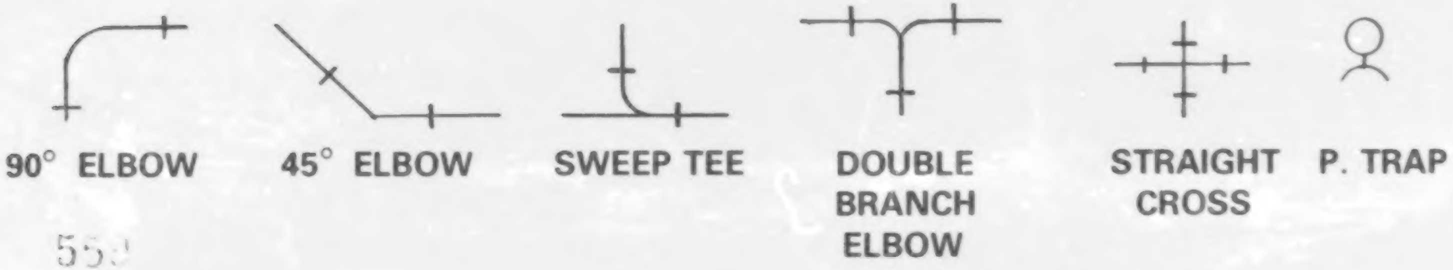

PL
WL
L
ML
DL
DW
Pedestal
Wall
Corner
Manicure
or Medical
Dental
Dishwasher
LAVATORIES

Mechanical Symbols

(Continued)

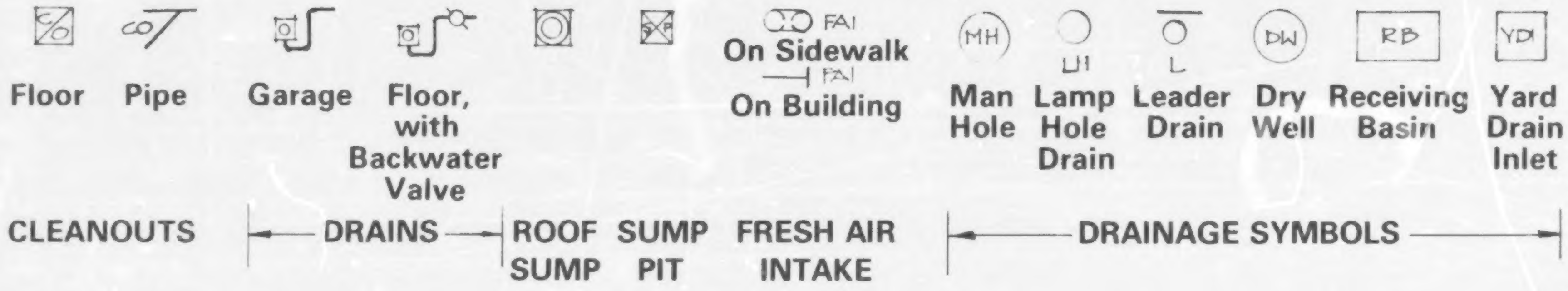

S
Plain Kitchen
Kitchen, R & L Drain Board
Kitchen, L.H. Drain Board
Combination Sink & Dishwasher
S T
Combination Sink & Laundry Tray
SS
Service
Wash (Wall Type)
Wash (Free-standing)
HWT
Tank
WH
Heater
SINKS
HOT WATER

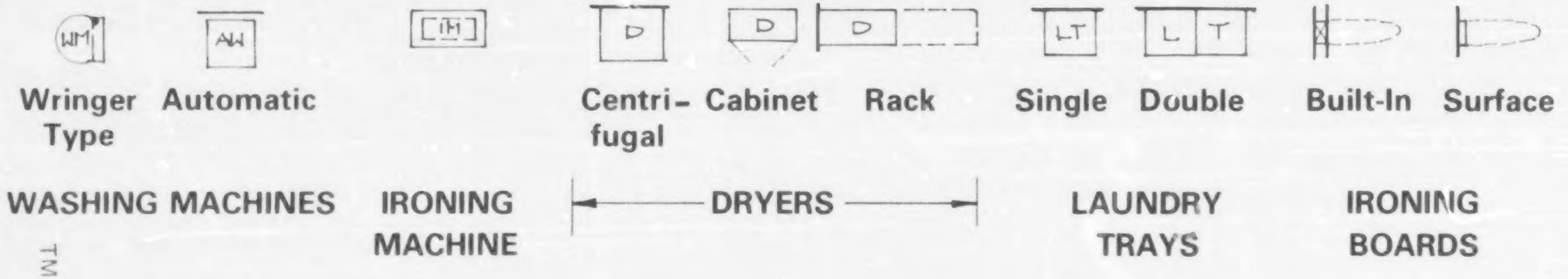

DF
DF
Pedestal Type
Wall Type
Trough Type
DRINKING FOUNTAINS
M
METER
HR
HOSE RACK
HF
HB
HOSE BIBS OR FAUCET
R
GAS RANGE
G
Gas Vacuum
OUTLETS
D
DRAIN
G
Grease
Oil
SEPARATORS
L
LEADER


90° ELBOW
45° ELBOW
SWEEP TEE
DOUBLE BRANCH ELBOW
STRAIGHT CROSS
P. TRAP

Mechanical Symbols

(Continued)

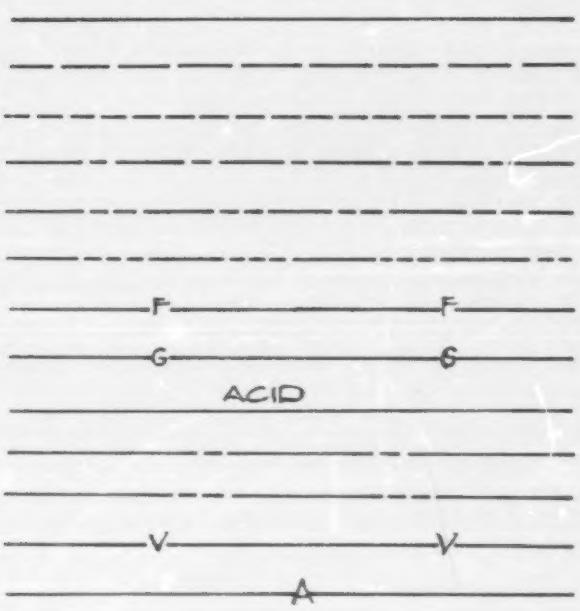

CO
CO
FAI
On Sidewalk
FAI
On Building
MH
LH
L
DW
RB
YDI
Floor
Pipe
Garage
Floor, with Backwater Valve
Man Hole
Lamp Hole Drain
Leader Drain
Dry Well
Receiving Basin
Yard Drain Inlet
CLEANOUTS
DRAINS
ROOF SUMP
SUMP PIT
FRESH AIR INTAKE
DRAINAGE SYMBOLS


WM
AW
IM
D
D
D
LT
L
T
Wringer Type
Automatic
Centrifugal
Cabinet
Rack
Single
Double
Built-In
Surface
WASHING MACHINES
IRONING MACHINE
DRYERS
LAUNDRY TRAYS
IRONING BOARDS

Mechanical Symbols

(Continued)

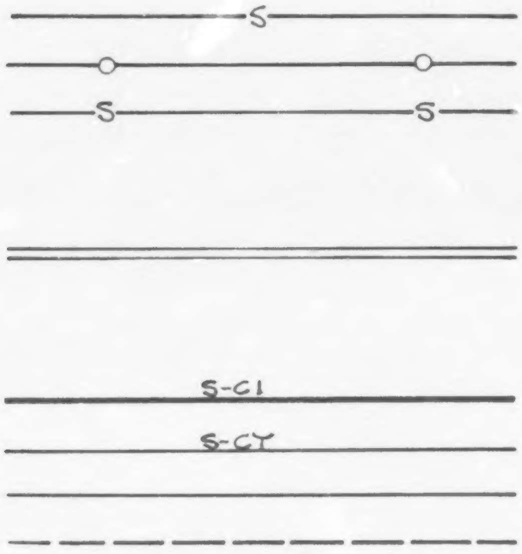
PLUMBING



Soil, Waste or Leader (Above Grade)
Soil, Waste or Leader (Below Grade)
Vent
Cold Water
Hot Water
Hot Water Return
Fire Line
Gas
Acid Waste
Drinking Water Flow
Drinking Water Return
Vacuum Cleaning
Compressed Air

Mechanical Symbols

(Continued)



SPRINKLERS

Main Supplies

Branch and Head

Drain

PNEUMATIC TUBES

Tube Runs

DRAINAGE

Sewer-Cast Iron

Sewer-Clay Tile, Bell & Spigot

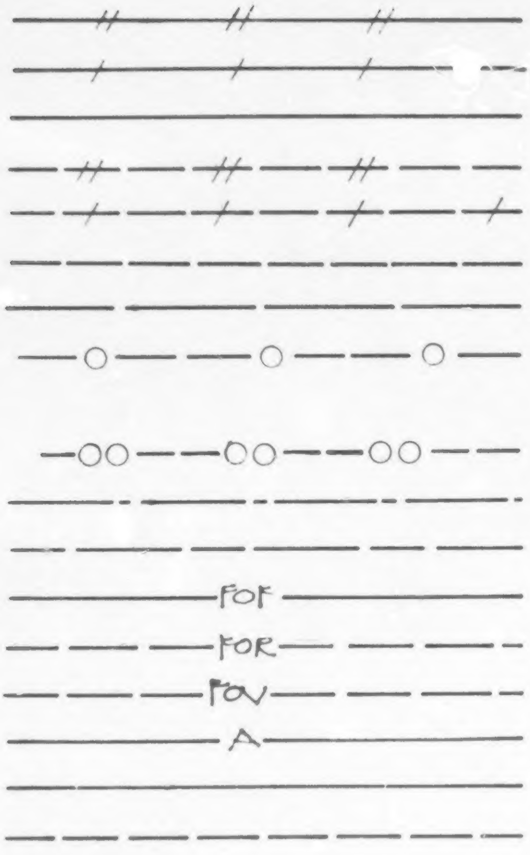
Drain-Clay Tile, Bell & Spigot

Drain-Open Tile or Agricultural Tile

Mechanical Symbols

(Continued)

HEATING



High Pressure Steam
Medium Pressure Steam
Low Pressure Steam
High Pressure Return
Medium Pressure Return
Low Pressure Return
Boiler Blow Off
Condensate or Vacuum Pump Discharge
Feedwater Pump Discharge
Make Up Water
Air Relief Line
Fuel Oil Flow
Fuel Oil Return
Fuel Oil Tank Vent
Compressed Air
Hot Water Heating Supply
Hot Water Heating Return

TM 26

Mechanical Symbols

(Continued)

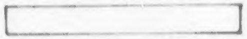
AIR CONDITIONING

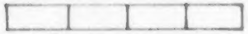
———— RD ————	**Refrigerant Discharge**
— — — RS — — —	**Refrigerant Suction**
———— C ————	**Condenser Water Flow**
— — — CR — — —	**Condenser Water Return**
———— CH ————	**Circulating Chilled or Hot Water Flow**
— — — CHR — — —	**Circulating Chilled or Hot Water Return**
—— - —— - —— - ——	**Make Up Water**
—— - —— H —— - ——	**Humidification Line**
———— D ————	**Drain**
———— B ————	**Brine Supply**
— — — BR — — —	**Brine Return**

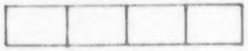
Mechanical Symbols

(Continued)

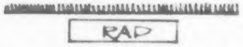
GENERAL


Heat Transfer Surface, Plan

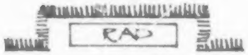

Wall Radiator, Plan


Wall Radiator on Ceiling, Plan

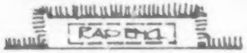
RADIATORS & CONVECTORS, PLANS- for Architectural Drawings. For Radiator - If Convector is Used Instead of Radiator, Substitute CONV. for RAD.



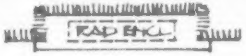
Exposed



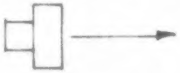
Recessed

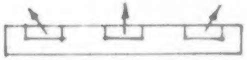


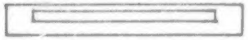
Enclosed, Flush



Enclosed, Projecting


Unit Heater (Propeller), Plan

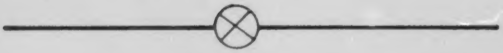

Unit Heater (Centrifugal Fan), Plan

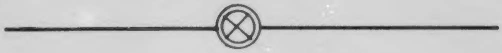

Unit Ventilator, Plan

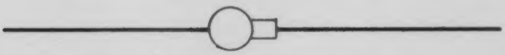
Mechanical Symbols

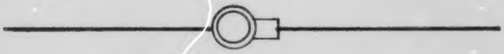
(Continued)

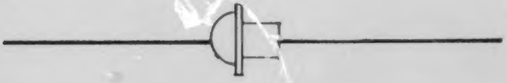
TRAPS


Thermostatic


Blast Thermostatic


Float and Thermostatic

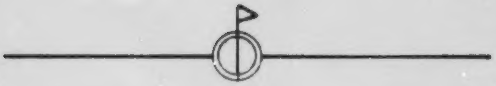

Float


Boiler Return

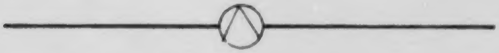
Mechanical Symbols

(Continued)

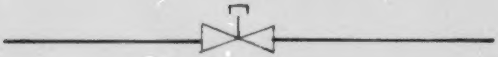
VALVES



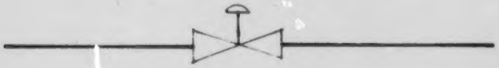
Reducing Pressure



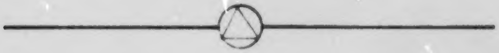
Air Line



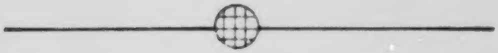
Lock and Shield



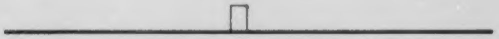
Diaphragm



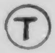
Air Eliminator



Strainer



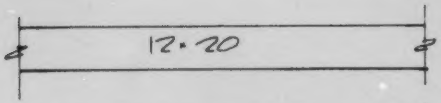
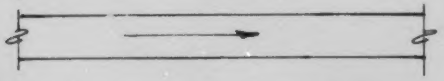
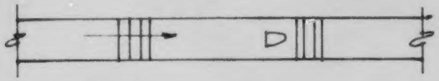
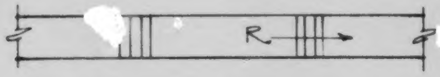
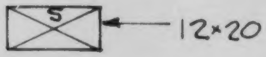
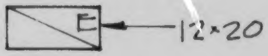
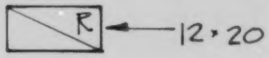
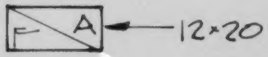
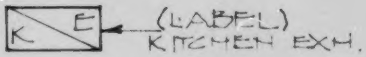
Thermometer



Thermostat

Mechanical Symbols

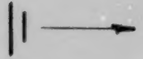
(Continued)

	**Duct (1st Figure, Width; 2nd, Depth)**
	**Direction of Flow**
	**Inclined Drop in Respect to Air Flow**
	**Inclined Rise in Respect to Air Flow**
	**Supply Duct Section**
	**Exhaust Duct Section**
	**Recirculation Duct Section**
	**Fresh Air Duct Section**
 K E (LABEL) KITCHEN EXH.	**Other Ducts Section**
R	**Register**

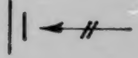
Mechanical Symbols

(Continued)

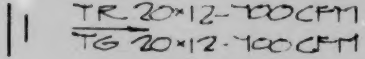
G **Grille**



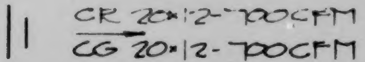
Supply Outlet



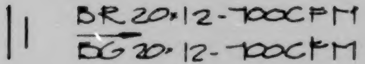
Exhaust Inlet


TR 20×12-700CFM
TG 20×12-700CFM

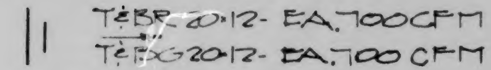
Top Register or Grille


CR 20×12-700CFM
CG 20×12-700CFM

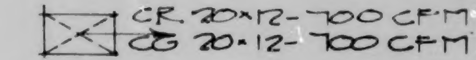
Center Register or Grille


BR 20×12-700CFM
BG 20×12-700CFM

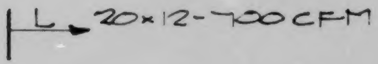
Bottom Register or Grille


T&BR 20×12- EA.700CFM
T&BG 20×12- EA.700 CFM

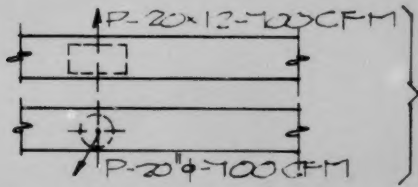
Top and Bottom Register or Grille


CR 20×12-700 CFM
CG 20×12-700 CFM

Ceiling Register or Grille


L 20×12-700 CFM

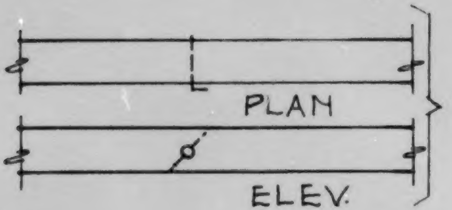
Louver Opening


P-20×12-700CFM
P-20"φ-700CFM

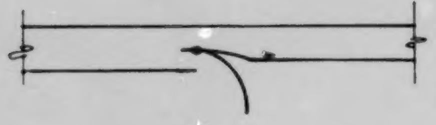
Adjustable Plaque

Mechanical Symbols

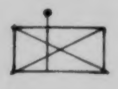
(Continued)



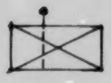
Volume Damper



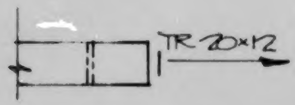
Deflecting Damper



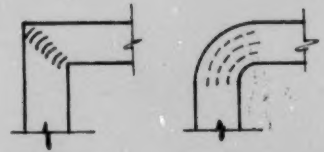
Deflecting Damper, Up



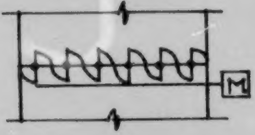
Deflecting Damper, Down



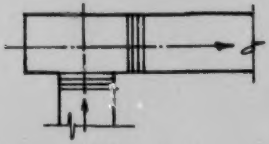
Adjustable Blank Off



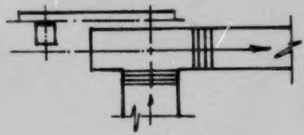
Vanes



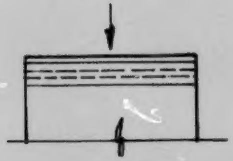
Automatic Dampers



Canvas Connections



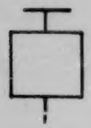
Fan and Motor with Belt Guard



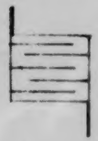
Intake Louvers and Screen

Mechanical Symbols

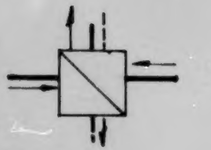
(Continued)



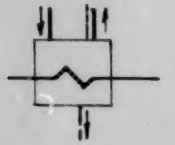
Steam Generator (Boiler)



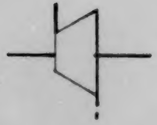
Flue Gas Reheater (Intermediate Superheater)



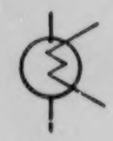
Live Steam Superheater



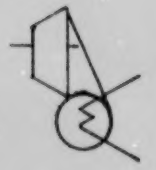
Feed Heater with Air Outlet



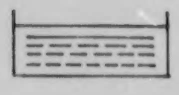
Steam Turbine



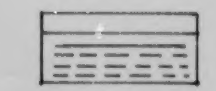
Surface Condenser



Condensing Turbine



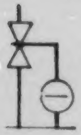
Open Tank



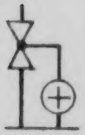
Closed Tank

Mechanical Symbols

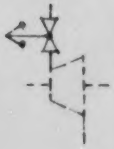
(Continued)



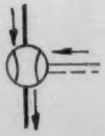
Automatic Reducing Valve



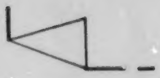
Automatic By-pass Valve



Automatic Valve Operated by Governor

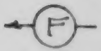


Dynamic Pump (Air Ejector)

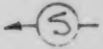


Steam Trap

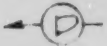
Pumps



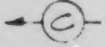
Boiler Feed



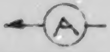
Service



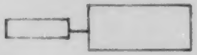
Condensate



Circulating Water



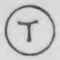
Air



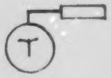
Reciprocating

Mechanical Symbols

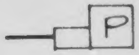
(Continued)



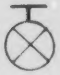
Thermostat (Self Contained)



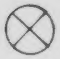
Thermostat (Remote Bulb)



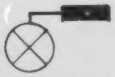
Pressure Switch



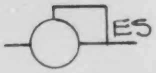
Hand Expansion Valve



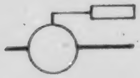
Automatic Expansion Valve



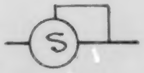
Thermostatic Expansion Valve



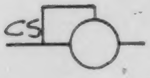
Valve, Evaporator Pressure Regulating, Throttling Type (Evaporator Side)



Valve, Evaporator Pressure Regulating, Thermostatic Throttling Type



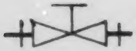
Valve, Evaporator Pressure Regulating, Snap-Action Valve



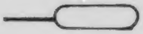
Valve, Compressor Suction Pressure Limiting, Throttling Type (Compressor Side)

Mechanical Symbols

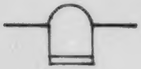
(Continued)



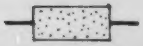
Hand Shut Off Valve (Flanged)



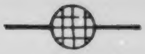
Thermal Bulb



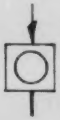
Scale Trap



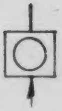
Dryer



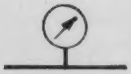
Strainer



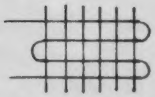
High Side Float



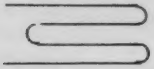
Low Side Float



Gage



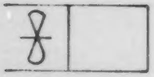
Finned Type Cooling Unit, Natural Convection

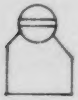


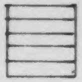
Pipe Coil

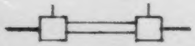
Mechanical Symbols

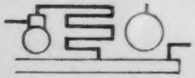
(Continued)

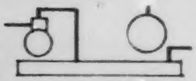

Forced Convection Cooling Unit

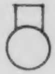

Immersion Cooling Unit

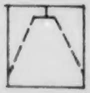

Ice Making Unit

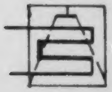

Heat Interchanger

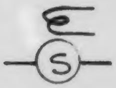

Condensing Unit, Air Cooled


Condensing Unit, Water Cooled

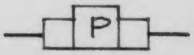

Compressor


Cooling Tower


Evaporative Condenser



Solenoid Valve



Pressure Switch with High Pressure Cut-Out

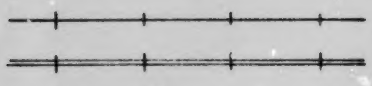
Topography Symbols

EXISTING AND FINISH CONTOUR LINES

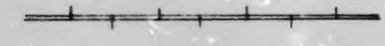
━━━━━━━━	Hard surface, heavy duty road, four or more lanes
────────	Hard surface, heavy duty road, two or three lanes
━ ━ ━ ━ ━	Hard surface, medium duty road, four or more lanes
– – – – –	Hard surface, medium duty road, two or three lanes
════════	Improved light duty road
= = = = = =	Unimproved dirt road-Trail
≡≡≡≡≡≡≡≡	Dual highway, dividing strip 25 feet or less
≣≣≣≣≣≣≣≣	Dual highway, dividing strip exceeding 25 feet
= = = = = =	Road under construction

Topography Symbols

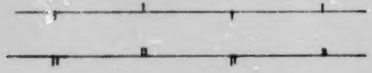
(Continued)



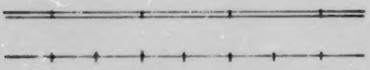
Railroad: single track-multiple track



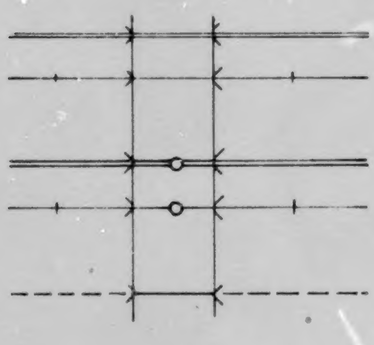
Railroads in juxtaposition



Narrow gage: single track-multiple track



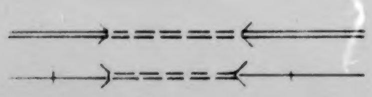
Railroad in street-Carline



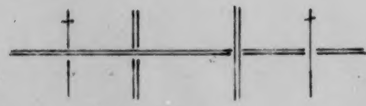
Bridge: road-railroad

Drawbridge: road-railroad

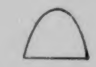
Footbridge



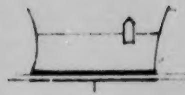
Tunnel: road-railroad



Overpass-Underpass

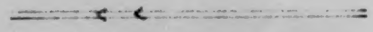


Important small masonry or earth dam



Dam with lock

Dam with road



Canal with lock

Topography Symbols

(Continued)

▪ ▪ ▮ ◻ ▭		**Buildings (dwelling, place of employment, etc.)**
⚑ ✝ [✝] [CEM.]		**School-Church-Cemeteries**
▫ ▭ ▨ ▨		**Buildings (barn, warehouse, etc.)**
-·-·-·-·-		**Power transmission line**
- - - - - - - -		**Telephone line, pipeline, etc. (labeled as to type)**
○OIL ○GAS		**Wells other than water (labeled as to type)**
• ● ● ◍WATER		**Tanks; oil, water, etc. (labeled as to type)**
○	ȣ	**Located or landmark object-Windmill**
⚒	x	**Open pit, mine, or quarry-Prospect**
◩	Y	**Shaft-Tunnel entrance**

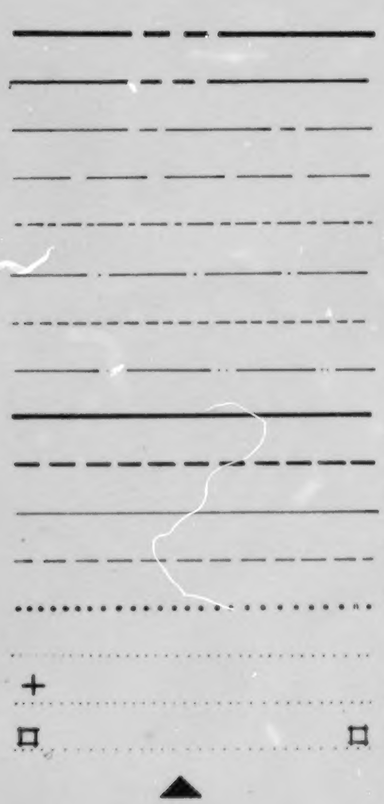
Topography Symbols

(Continued)

Horizontal and vertical control station:	
tablet, spirit level elevation	BM△3899
other recoverable mark, spirit level elevation	△3938
Horizontal control station: tablet, vertical angle elevation	VABM△2914
any recoverable mark, vertical angle or checked elevation	*△5657*
Vertical control station: tablet, spirit level elevation	BMX945
other recoverable mark, spirit level elevation	X890
Checked spot elevation	*x5923*
Unchecked spot elevation-Water elevation	*x5657---870*

Topography Symbols

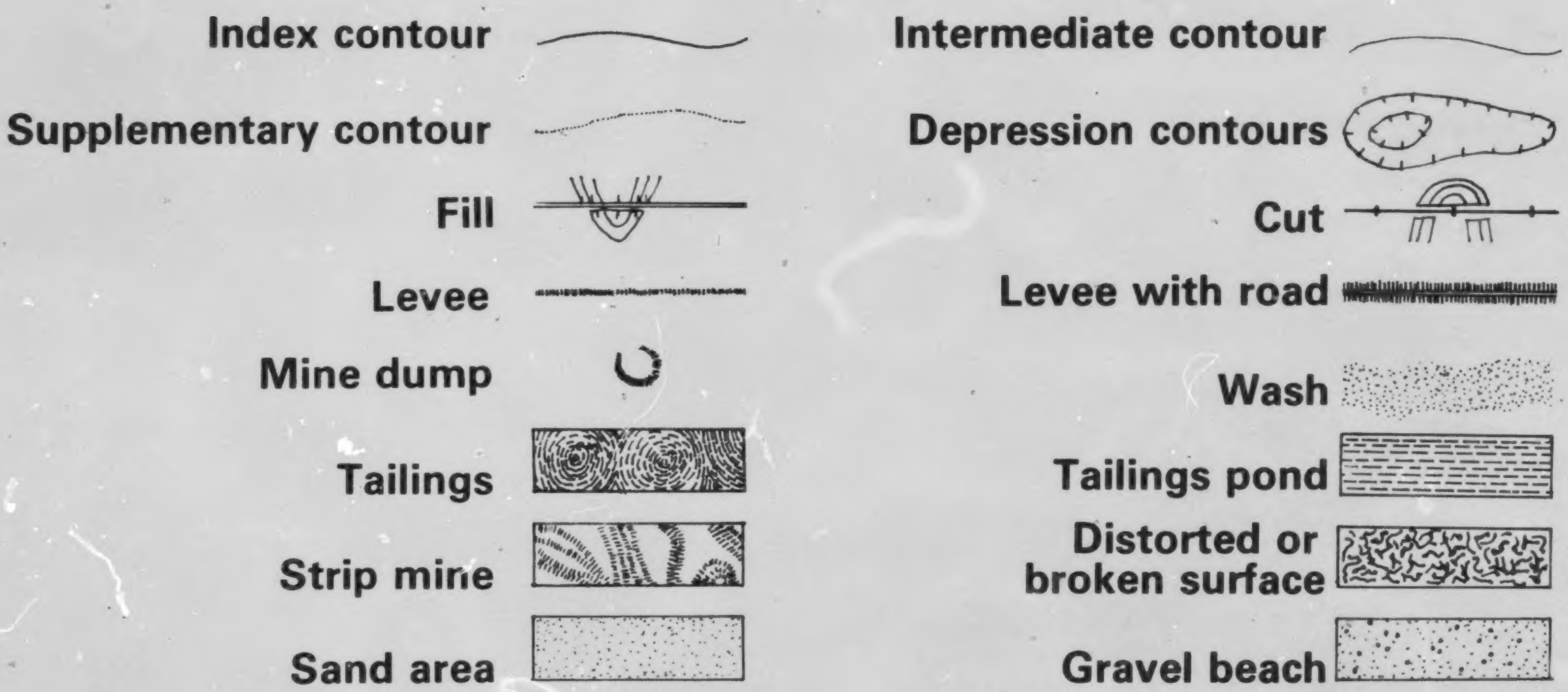
(Continued)



Boundary: national
state
county, parish, municipio
civil township, precinct, town, barrio
incorporated city, village, town, hamlet
reservation, national or state
small park, cemetery, airport, etc.
land grant
Township or range line, U.S. land survey
Township or range line, approximate location
Section line, U.S. land survey
Section line, approximate location
Township line, not U.S. land survey
Section line, not U.S. land survey
Section corner: found-indicated
Boundary monument: land grant-other
U.S. mineral or location monument

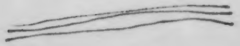
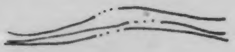
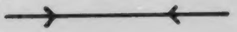
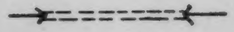
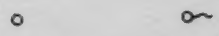
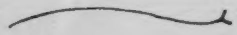
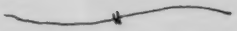
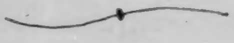
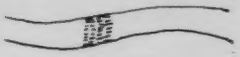
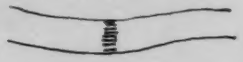
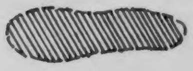
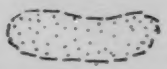
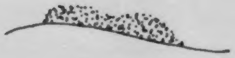
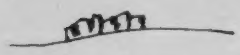
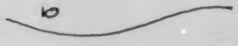
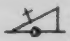
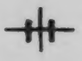
Topography Symbols

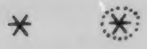
(Continued)


Index contour
Intermediate contour
Supplementary contour
Depression contours
Fill
Cut
Levee
Levee with road
Mine dump
Wash
Tailings
Tailings pond
Strip mine
Distorted or broken surface
Sand area
Gravel beach

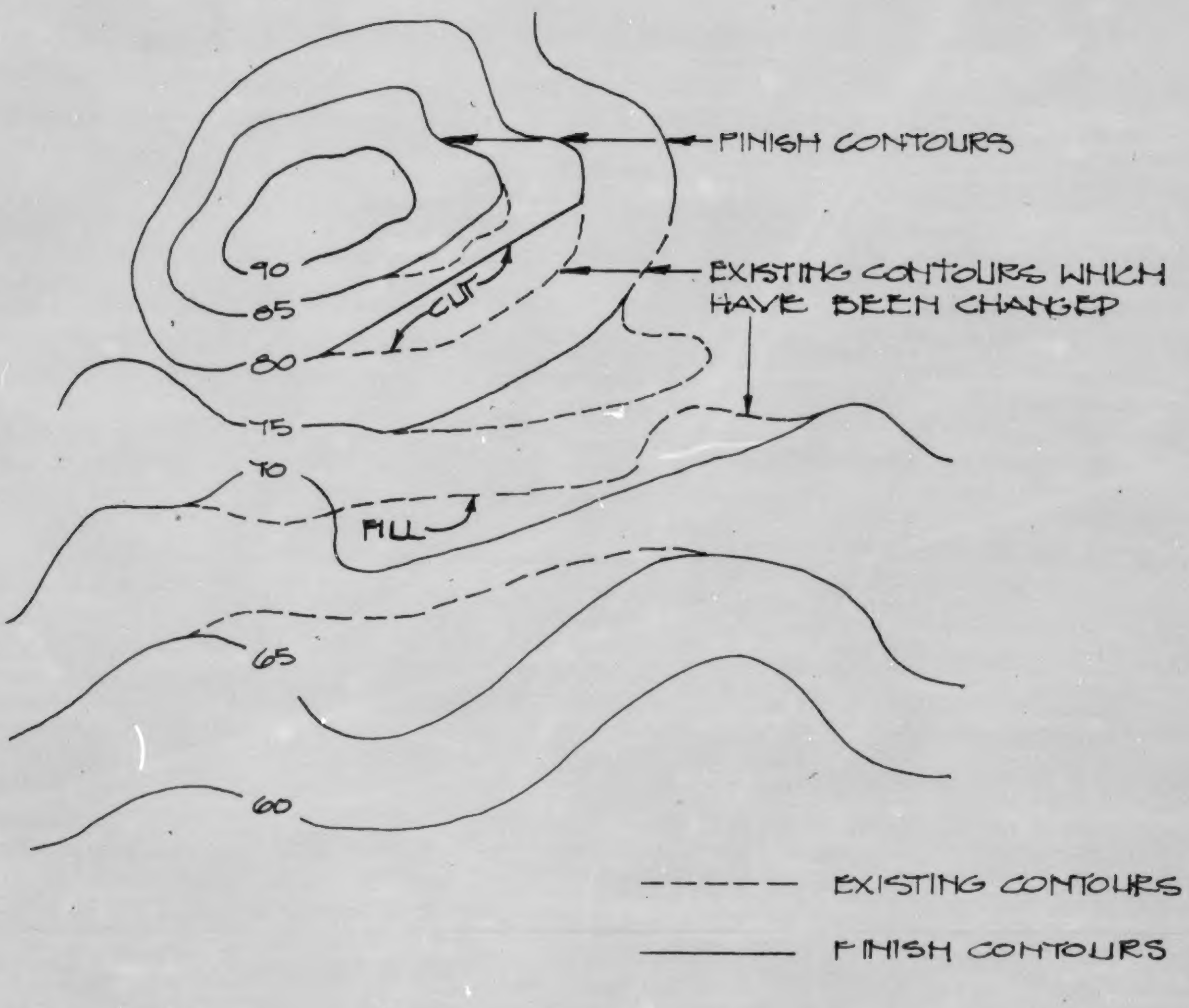
Topography Symbols

(Continued)

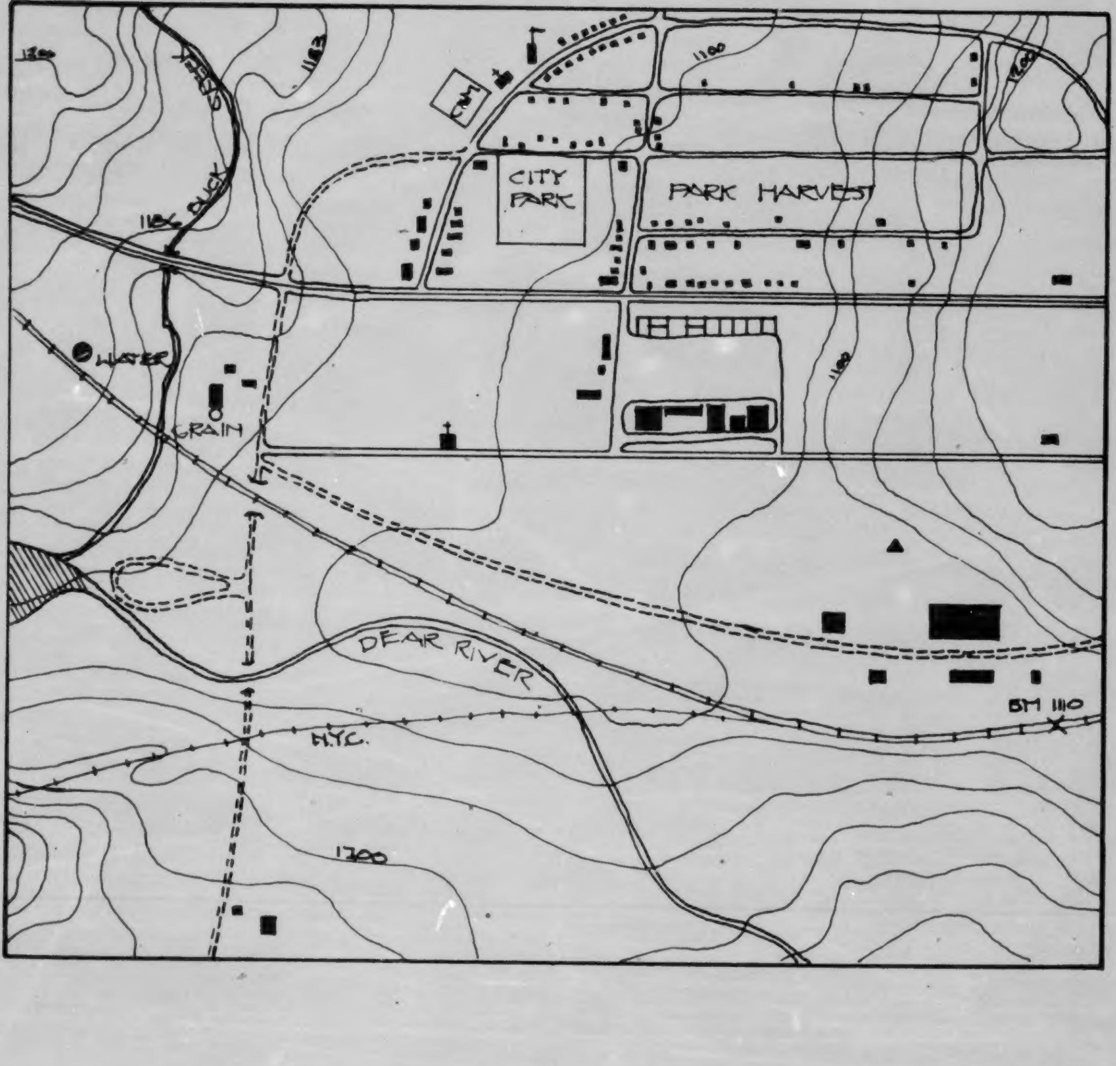
Perennial streams		**Intermittent streams**	
Elevated aqueduct		**Aqueduct tunnel**	
Water well-Spring		**Disappearing stream**	
Small rapids		**Small falls**	
Large rapids		**Large falls**	
Intermittent lake		**Dry lake**	
Foreshore flat		**Rock or coral reef**	
Sounding-Depth curve		**Piling or dolphin**	
Exposed wreck		**Sunken wreck**	

Rock, bare or awash--dangerous to navigation 

Site Survey


FINISH CONTOURS
EXISTING CONTOURS WHICH HAVE BEEN CHANGED
90
85
80
75
70
65
60
CUT
FILL
EXISTING CONTOURS
FINISH CONTOURS

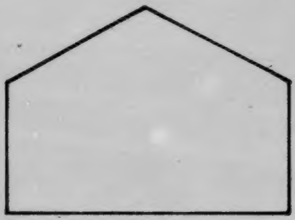
Topographic Map


1200
CREEK
1183
CEM
DUCK
1186
WATER
GRAIN
CITY PARK
PARK HARVEST
1100
1100
1180
DEAR RIVER
N.Y.C.
BM 1110
1200

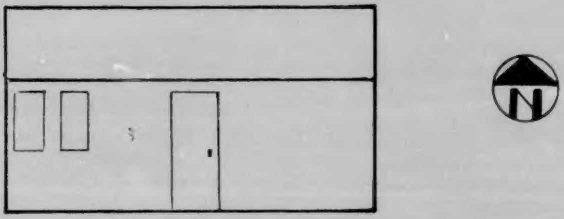
ADVANCED BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #1--IDENTIFY ARCHITECTURAL ELEVATIONS

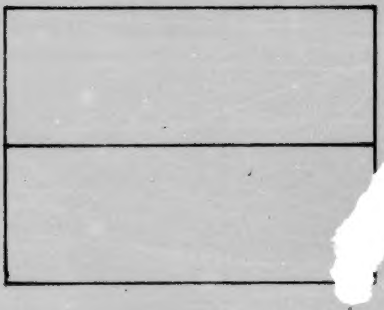
Identify the architectural elevations shown in the drawings below.



1. ______________________



2. ______________________



3. ______________________

ADVANCED BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #2--IDENTIFY ARCHITECTURAL SCHEDULES

Identify the schedules pictured below.

TYPE	SIZE	REMARKS
X	2'-6"×4'-1"	D. HUNG
Y	3'-0"×4'-0"	CASEMENT
Z	2'-3"×3'-1"	D. HUNG

NO.	TYPE	SIZE	REMARKS
101	A	2'-8"×6'-8"×1 3/4"	DETAIL
102	C	2'-6"×6'-6"×1 3/8"	STOCK
103	B	2'-6"×6'-8"× 1 3/4	GLAZED
104	C	2'-6" × 6'-6"×1 3/8"	INTERIOR
105	C	2'-6"× 6'6"×1 3/8	INTERIOR

1. ______________________________ 2. ______________________________

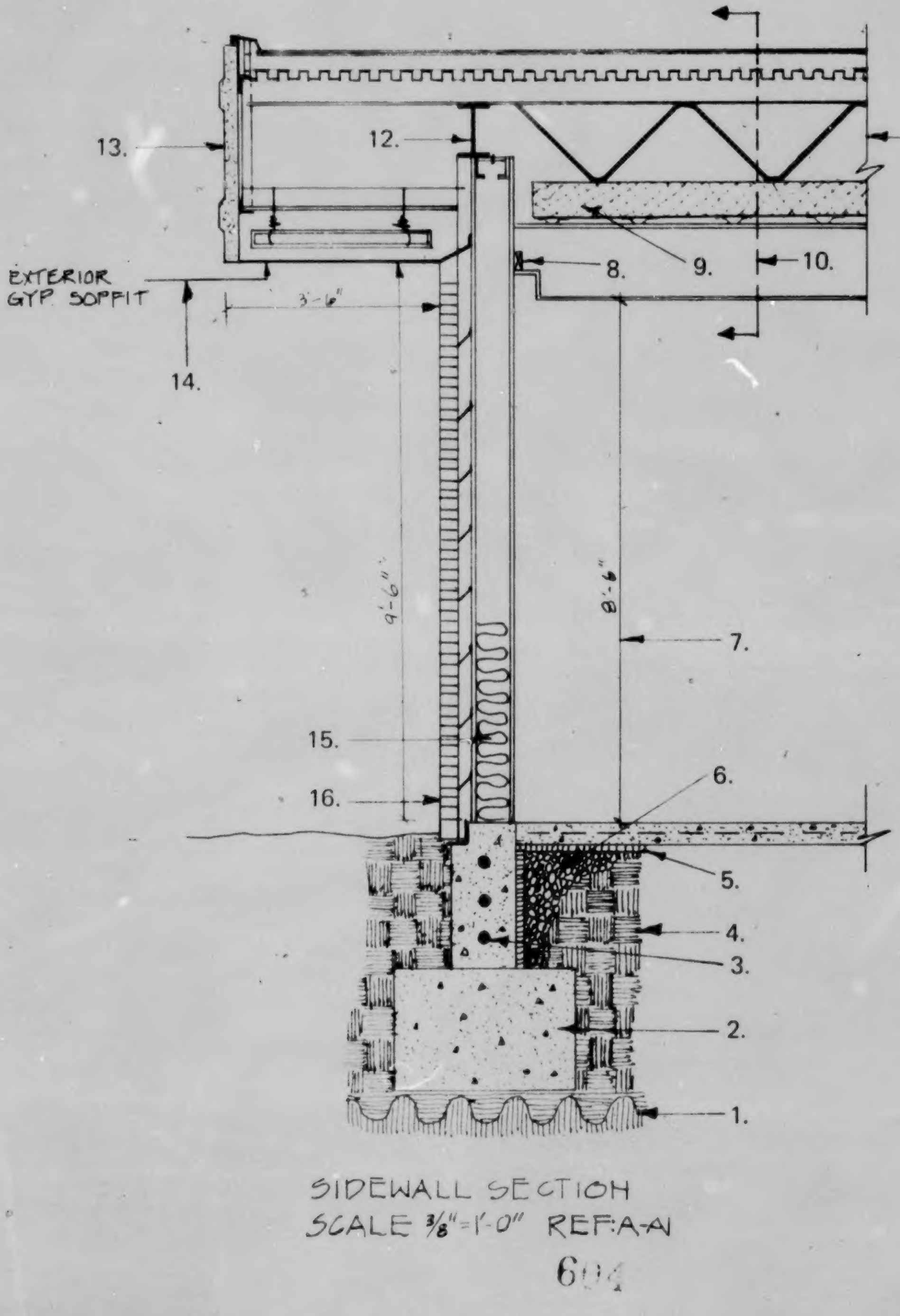
ROOM	WALLS	DADO	BASE	FLOOR	CEILING	CORNICE	REMARKS
LIV. ROOM	PLASTER	CANVAS	WOOD	CARPET	ACOUSTIC	WOOD	BOOKCASE
DIN. ROOM	PLASTER	PANEL	WOOD	OAK	PLASTER	PIC. MOLD	CABINETS
KITCHEN	PLASTER	4'0" TILE	TILE	OAK	PLASTER	———	CABINETS
HALL	PLASTER	———	WOOD	LINOLEUM	PLASTER	WOOD	SEE DETAIL
ENTRY	PLASTER	———	WOOD	OAK	PLASTER	———	———
BATH	DRY WALL	4'0" TILE	TILE	TILE	PLASTER	———	———

3. ______________________________

ADVANCED BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #3--IDENTIFY LINES AND SYMBOLS

Use the drawing below to identify the lines and symbols. Write the correct names in the blanks provided on the next page.


13.
12.
11.
9.
8.
10.
EXTERIOR GYP. SOFFIT
3'-6"
14.
9'-6"
8'-6"
7.
15.
16.
6.
5.
4.
3.
2.
1.

SIDEWALL SECTION
SCALE 3/8"=1'-0" REF:A-A1

ASSIGNMENT SHEET #3

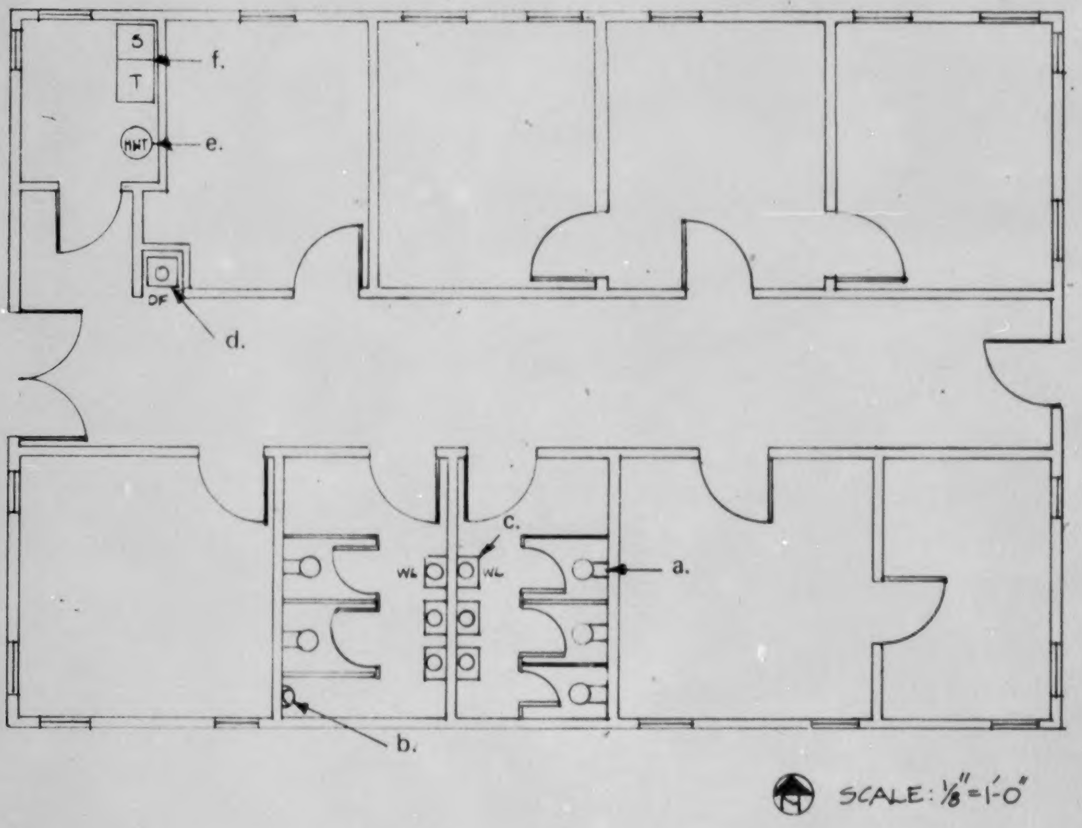
1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________
11. ______________________
12. ______________________
13. ______________________
14. ______________________
15. ______________________
16. ______________________

ADVANCED BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #4--IDENTIFY MECHANICAL SYMBOLS

Use the drawings below and on the following pages to identify mechanical symbols. Write the correct names in the blanks provided.

1.


S
T
f.
MWT
e.
DF
d.
c.
WL
WL
a.
b.
SCALE: 1/8"=1'-0"

a. ______________________

b. ______________________

c. ______________________

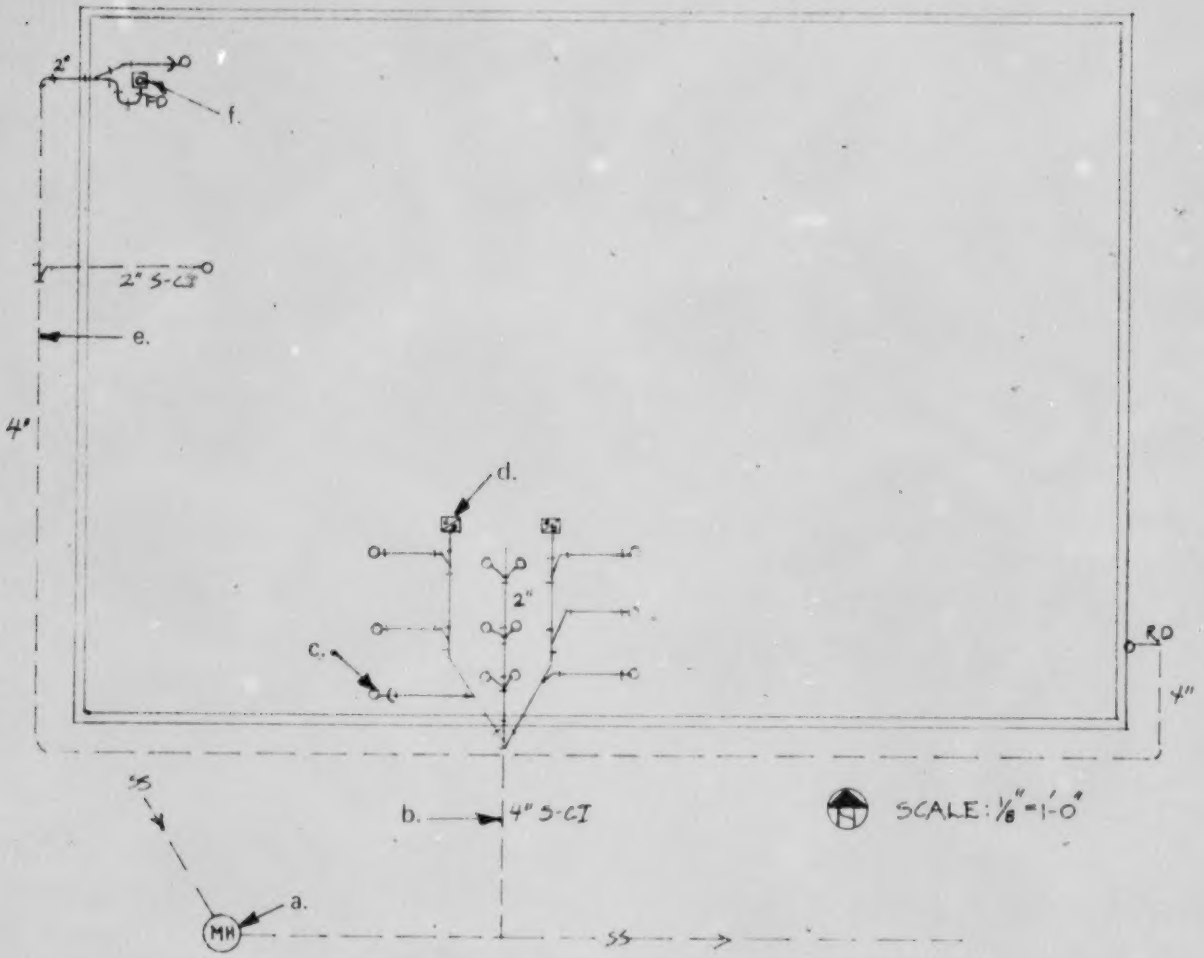
d. ______________________

e. ______________________

f. ______________________

ASSIGNMENT SHEET #4

2.


2"
FD
f.
2" S-CI
e.
4"
d.
2"
c.
RD
4"
SS
b.
4" S-CI
SCALE: 1/8"=1'-0"
a.
MH
SS

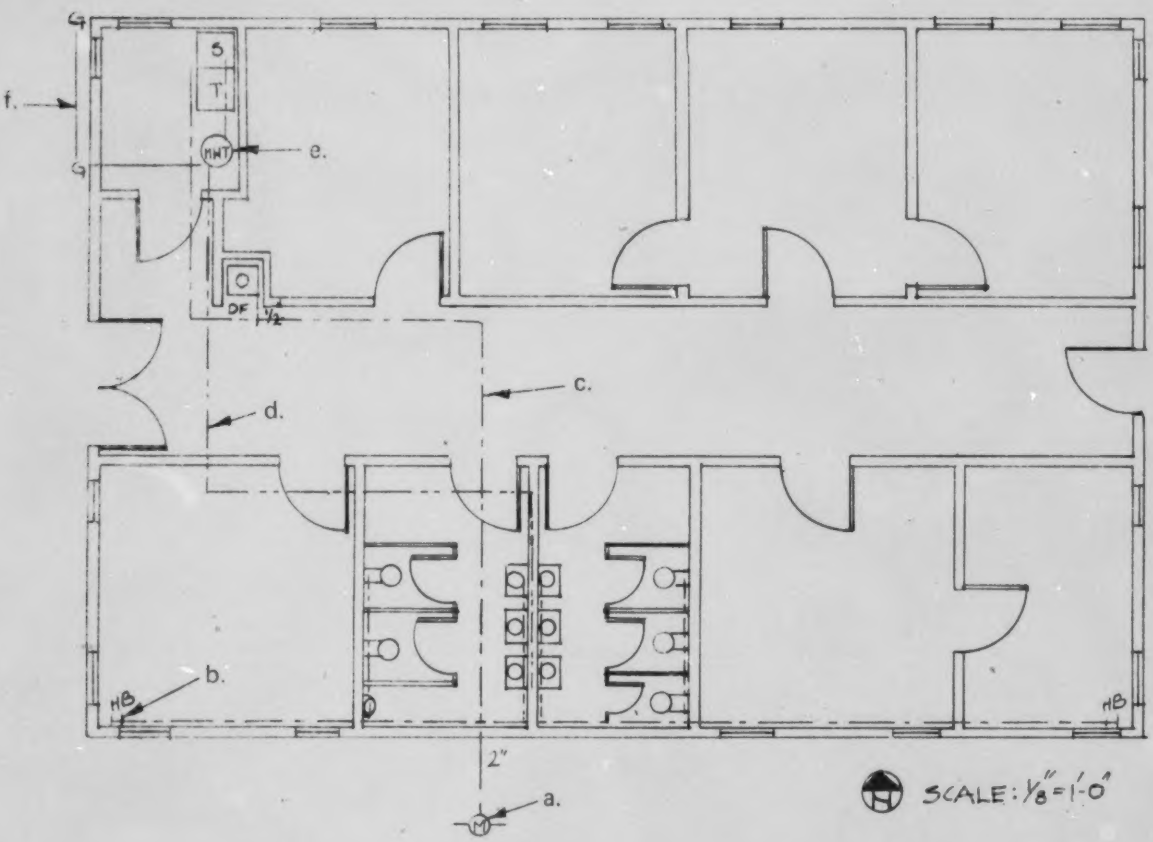
a. ____________________ d. ____________________

b. ____________________ e. ____________________

c. ____________________ f. ____________________

ASSIGNMENT SHEET #4

3.


G
f.
G
S
T
MWT
e.
DF
1 1/2
c.
d.
b.
HB
HB
2"
a.
M
SCALE: 1/8" = 1'-0"

a. ______________________

b. ______________________

c. ______________________

d. ______________________

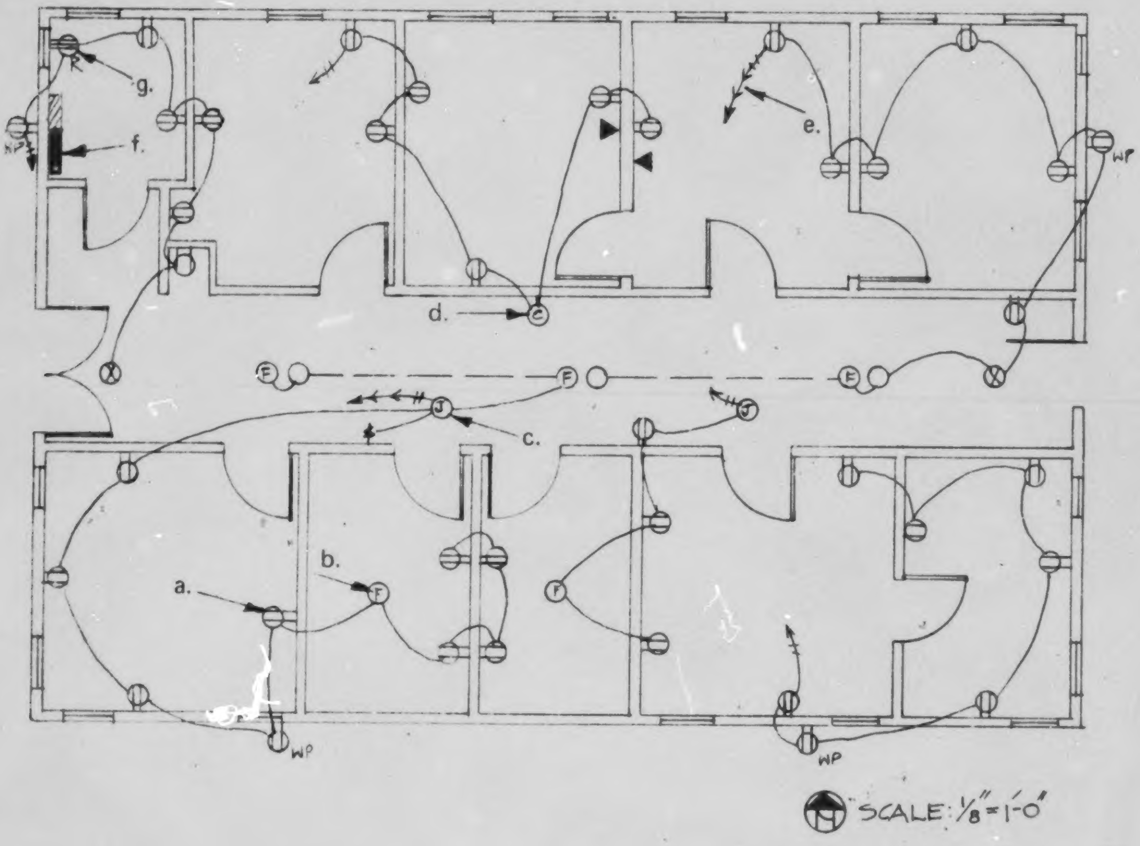
e. ______________________

f. ______________________

ADVANCED BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #5--IDENTIFY ELECTRICAL SYMBOLS

1. Use the drawing below to identify electrical symbols. Write the correct names in the blanks provided.


g.
R
f.
WP
e.
WP
d.
c.
b.
a.
WP
WP
SCALE: 1/8" = 1'-0"

a. ______________________

b. ______________________

c. ______________________

d. ______________________

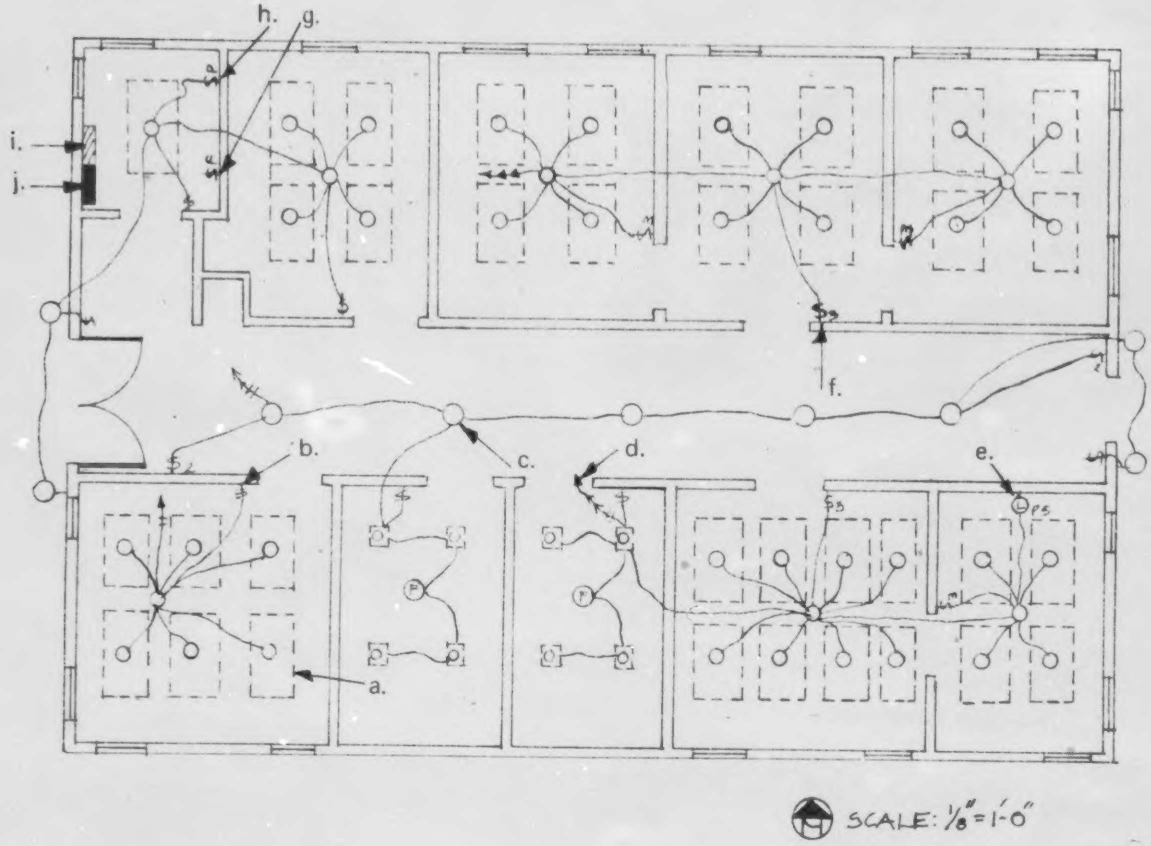
e. ______________________

f. ______________________

g. ______________________

ASSIGNMENT SHEET #5

2. Use the drawing below to identify the electrical symbols.


h.
g.
i.
j.
b.
c.
d.
e.
f.
a.
S_3
PS
SCALE: 1/8" = 1'-0"

a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

f. ______________________

g. ______________________

h. ______________________

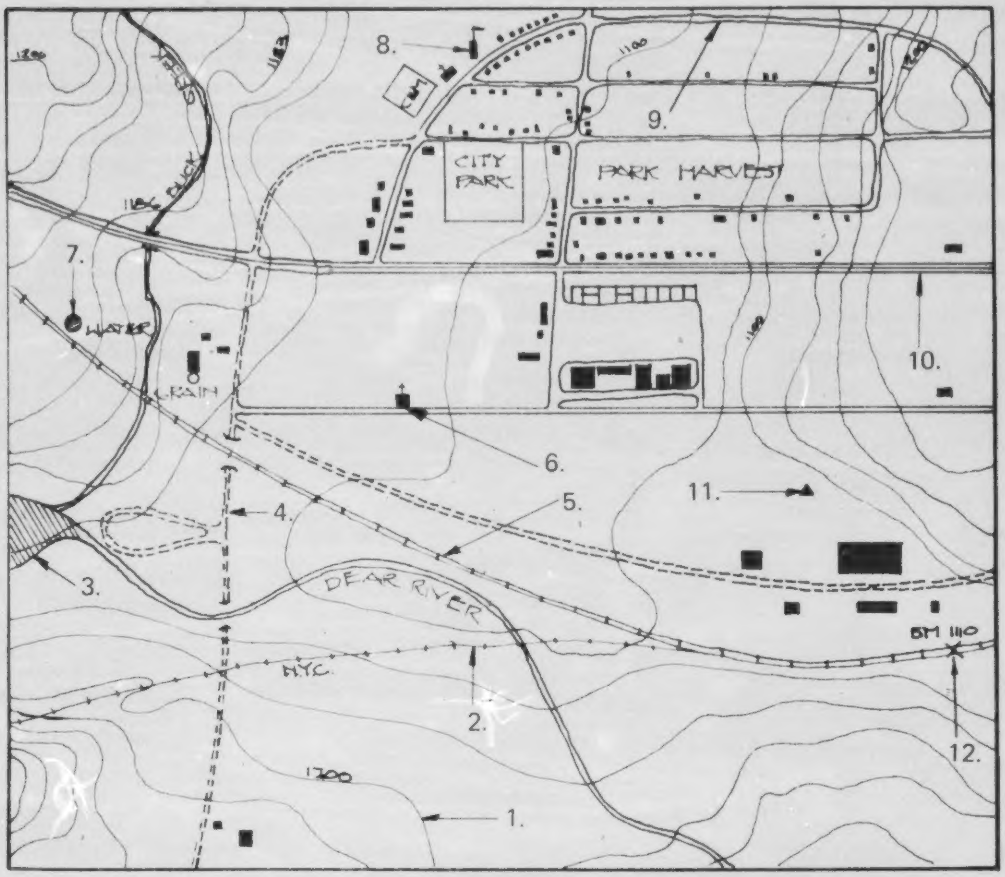
i. ______________________

j. ______________________

ADVANCED BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #6--IDENTIFY TOPOGRAPHIC SYMBOLS

Use the drawing below to identify topographic symbols. Write the correct names in the blanks provided.


1200
1150
DUCK CREEK
1100
8.
9.
CITY PARK
PARK HARVEST
7.
WATER
GRAIN
10.
6.
4.
5.
11.
3.
DEAR RIVER
N.Y.C.
BM 1110
2.
12.
1700
1.

Segment of a geographical survey map

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________
11. ______________________________
12. ______________________________

ADVANCED BLUEPRINT READING
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. East or west elevation
2. North elevation
3. Plan

Assignment Sheet #2

1. Window
2. Door
3. Finish

Assignment Sheet #3

1. Rock
2. Concrete
3. Reinforcing bars
4. Earth
5. Insulation (solid)
6. Gravel
7. Dimension line
8. Rough lumber
9. Insulation (quilts)
10. Section line
11. Break line
12. Structural steel
13. Cut stone
14. Leader line
15. Insulation (batts or loose fill)
16. Face brick

Assignment Sheet #4

1. a. Water closet (no tank)
   b. Urinal (wall type)
   c. Lavatory (wall)
   d. Drinking fountain
   e. Hot water tank
   f. Combination sink and laundry tray

2. a. Manhole
   b. 4" sewer, cast iron
   c. P trap
   d. Clean out
   e. 4" waste
   f. Floor drain

3. a. Meter
   b. Hose bib
   c. Cold water line
   d. Hot water line
   e. Hot water tank
   f. Gas line

Assignment Sheet #5

1. a. Duplex convenience outlet
   b. Fan outlet
   c. Junction box
   d. Clock outlet
   e. Homerun to panel, 3 circuits
   f. Lighting panel
   g. Range outlet

2. a. Ceiling light outlet (recessed)
   b. Single pole switch
   c. Ceiling light fixture
   d. Home run to panel, 3 circuits
   e. Lamp holder with pull switch
   f. Three way switch
   g. Fused switch
   h. Switch and pilot light

   i. Power panel

   j. Lighting panel

Assignment Sheet #6

1. Contour line
2. Single track railroad
3. Intermittent lake
4. Unimproved dirt road
5. Multiple track railroad
6. Church
7. Water tank
8. School
9. Improved light duty road
10. Dual highway, dividing strip 25 feet or less
11. U.S. mineral or location monument
12. Bench mark

ADVANCED BLUEPRINT READING
UNIT II

TEST

NAME ______________________ SCORE ____________

1. Match terms on the right to the correct definitions by placing the appropriate numbers in the blanks povided. Terms and definitions are continued on the following page.

______a. Having four equal sides and four right angles

______b. Having four sides and four right angles with two sides being equal and longer than the other two sides which are also equal

______c. Triangle having a right angle

______d. Closed plane curve every point of which is of equal distance from the exact center

______e. Form, either solid or void, with the top and bottom being equal and parallel to each other and the sides being parallelograms

______f. Arbitrary sign that has been standardized and is used to represent an object, quality, or method; pictorial way of showing conventional facts used in the construction trades

______g. Standardized methods by which architects show given facts

______h. Written, detailed descriptions that cover all features of work to be done, materials to use, method of installation, and quality of work that are not shown on drawings

______i. Systematic methods of presenting information and notes

______j. Shortened form of a word or phrase

______k. Geometrical figures or elements having three dimensions, such as a cube or sphere

1. Right triangle
2. Symbol
3. Schedules
4. Conventions
5. Square
6. Specifications
7. Prism
8. Circle
9. Rectangle
10. Abbreviation
11. Solids

614-A

______l. Written agreement between an owner, builder, architect, and/or engineer defining the responsibilities of each to the other

______m. View showing exactly what you see when looking at an object or structure; resembles a photograph

______n. System of drawing with measurements on an equal scale in every one of three sets of lines 120° apart and representing the three planes of the dimensions

______o. Arrangement of lines and symbols to indicate the actual size for constructing the object or structure that is represented

______p. Written agreement between two or more persons or parties

______q. Copy of the original detailed drawing

______r. Map or drawing showing the configuration of a surface, including its relief and the location of its natural and constructed features

12. Topography
13. Contract document
14. Dimensions
15. Blueprints
16. Contract
17. Perspective view
18. Isometric projections

2. List six common shapes of surface and solids found in a set of plans.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

3. List the methods of illustrating an object or structure by a drawing.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

4. Match common abbreviations used on plan views to the correct meanings by placing appropriate numbers in the blanks provided.

______a. Acoustic
______b. Anchor bolt
______c. Architectural
______d. Asphalt tile
______e. Beam
______f. Bearing plate
______g. Blueprint
______h. Building
______i. Building line
______j. Casing
______k. Catch basin
______l. Cement
______m. Center
______n. Center line
______o. Circuit breaker
______p. Cold water
______q. Collar beam
______r. Concrete
______s. Contract
______t. Cubic feet
______u. Detail
______v. Diagram
______w. Dimension
______x. Downspout
______y. Excavate
______z. Expansion joint

1. ARCH
2. BM
3. ACST
4. BP
5. BL
6. AB
7. AT
8. BRG PL
9. BLDG
10. CW
11. CONT
12. DET
13. DS
14. CSG
15. CB
16. EXC
17. DIM
18. CEM
19. EXP JT
20. CIR BKR
21. DIAG
22. COL B
23. ℄ or CL
24. CTR
25. CONC
26. CU FT

____aa. Exterior
____bb. Finish
____cc. Fireproof
____dd. Footing
____ee. Foundation
____ff. Full size
____gg. Hardware
____hh. Hose bib
____ii. I beam
____jj. Inside diameter
____kk. Insulation
____ll. Length
____mm. On center
____nn. Overhead
____oo. Plumbing
____pp. Reinforce or reinforcing
____qq. Schedule
____rr. Section
____ss. Specification
____tt. Typical
____uu. Unexcavated
____vv. Waterproof
____ww. Wide flange
____xx. Wood frame

27. FND
28. FPRF
29. I
30. HB
31. ID
32. INS
33. HDW
34. EXT
35. FIN
36. FS
37. FTG
38. OVHD
39. SCH
40. SPEC
41. WP
42. TYP
43. L, LG, or LNG
44. UNEXC
45. WF
46. REINF
47. OC
48. SECT
49. PLBG

5. List four conventions used by architects.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

6. List the parts of a contract document.

   a.

   b.

   c.

7. Explain in a few words the relationship between drawings and specifications.

8. Explain the difference between nominal and actual dimensions.

9. List the schedules commonly used by architects.

   a.

   b.

   c.

   d.

   e.

10. Define *contour lines*.

11. List standard types of symbols used in construction.

   a.

   b.

   c.

   d.

ADVANCED BLUEPRINT READING
UNIT II

ANSWERS TO TEST

1. a. 5
   b. 9
   c. 1
   d. 8
   e. 7
   f. 2
   g. 4
   h. 6
   i. 3
   j. 10
   k. 11
   l. 13
   m. 17
   n. 18
   o. 14
   p. 16
   q. 15
   r. 12

2. Any six of the following:
   a. Square
   b. Rectangle
   c. Right triangle
   d. Square and rectangle
   e. Square and triangle
   f. Solid square
   g. Solid rectangle
   h. Circle
   i. Prism
   j. Combinations

3. a. Perspectives
   b. Isometric views
   c. Development of surfaces
   d. Architectural elevations
   e. Topographic layouts

4.

a.	3	z.	19
b.	6	aa.	34
c.	1	bb.	35
d.	7	cc.	28
e.	2	dd.	37
f.	8	ee.	27
g.	4	ff.	36
h.	9	gg.	33
i.	5	hh.	30
j.	14	ii.	29
k.	15	jj.	31
l.	18	kk.	32
m.	24	ll.	43
n.	23	mm.	47
o.	20	nn.	38
p.	10	oo.	49
q.	22	pp.	46
r.	25	qq.	39
s.	11	rr.	48
t.	26	ss.	40
u.	12	tt.	42
v.	21	uu.	44
w.	17	vv.	41
x.	13	ww.	45
y.	16	xx.	45

5. Any four of the following:
   a. Methods of dimensioning walls, doors, and windows in concrete
   b. Dimensioning exterior and interior walls
   c. Dimensioning doors and windows in solid brick walls
   d. Dimensioning doors and windows in brick-veneer and wood stud walls
   e. Dimensioning interior doors and alterations
   f. Dimensioning window elevations
6. a. Contract
   b. Blueprints
   c. Specifications
7. a. Drawings furnish what the specifications cannot
   b. Specifications furnish what the drawings cannot
8. a. Nominal dimensions are rough figures
   b. Actual dimensions are exact figures
9. a. Finish
   b. Window
   c. Door
   d. Structural elements
   e. Lintel
10. Lines connecting points which have the same elevations and indicate the topography of the plot
11. a. Architectural
    b. Electrical
    c. Mechanical
    d. Topographic

BASIC MATH
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to calculate basic math problems. This knowledge will be evidenced by completion of assignment sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with basic math to the correct definitions.
2. Match the symbols used in math problems to their names.
3. Solve math problems involving addition.
4. Solve math problems involving subtraction.
5. Solve math problems involving division.
6. Solve math problems involving multiplication.
7. Identify the numerator and denominator in a given fraction.
8. Draw given fractions by dividing and shading figures.
9. Solve a fractional word problem using diagrams to illustrate the solution.
10. Distinguish between proper, improper, and mixed fractions.
11. Write different fractions which are equivalent to the number one.
12. Write different equivalent fractions for each of given fractions.
13. Write fractions as equivalent fractions with a given denominator.
14. Convert mixed numbers to improper fractions.
15. Convert improper fractions to mixed numbers or whole numbers.
16. Reduce fractions to lowest terms.
17. Write the place value of each digit in a numeral with six decimal places.
18. Write numbers in decimal notation.

19. Write number words as decimal numerals.
20. Write decimals to the nearest whole number, tenth, hundredth, and thousandth.
21. Solve problems involving addition of decimals.
22. Solve problems involving subtraction of decimals.
23. Solve problems involving multiplication of decimals.
24. Solve problems dividing a decimal by a decimal.
25. Solve problems dividing a whole number by a decimal.
26. Write fractions as decimals and percents.
27. Write percents as fractions and decimals.
28. Solve problems involving percents.
29. Compute the cost of a sale item.
30. Write decimal and fraction equivalents using a chart.
31. Calculate basic math problems dealing with area.
32. Write the formula for figuring board feet.
33. Compute board feet and cost.
34. Write the formula for estimating concrete.
35. Write the procedure for estimating wire mesh.
36. State the difference between ratio and proportion as related to concrete.

BASIC MATH
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide student with objective sheet.

   B. Provide student with information and assignment sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Provide chart on decimal equivalents for students to complete objective 29.

   G. Give test.

   (NOTE: It is recommended that this test be given in parts, such as the basic math processes, fractions, decimals, and job-related math.)

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Math Symbols

      2. TM 2--Area

      3. TM 3--Formula for Board Feet

      4. TM 4--Ordering Lumber

      5. TM 5--Formula for Estimating Concrete

      6. TM 6--Ratio and Proportion

   D. Assignment sheets

      1. Assignment Sheet #1--The 100 Addition Combinations

      2. Assignment Sheet #2--Two-Digit Numbers

3. Assignment Sheet #3--Three-Digit Numbers
4. Assignment Sheet #4--The 100 Subtraction Combinations
5. Assignment Sheet #5--Two-, Three-, and Four-Digit Numbers
6. Assignment Sheet #6--One-Digit Divisor
7. Assignment Sheet #7--Two-Digit Divisor
8. Assignment Sheet #8--Two- and Three-Digit Divisors
9. Assignment Sheet #9--Multiplication Facts
10. Assignment Sheet #10--Multiplying by a One-Digit Factor
11. Assignment Sheet #11--Multiplying by a Two-Digit Factor
12. Assignment Sheet #12--Parts of a Fraction
13. Assignment Sheet #13--Fractional Parts
14. Assignment Sheet #14--Fractional Word Problems
15. Assignment Sheet #15--Types of Fractions
16. Assignment Sheet #16--Equivalent Fractions
17. Assignment Sheet #17--Fraction Conversion
18. Assignment Sheet #18--Reducing Fractions
19. Assignment Sheet #19--Decimal Notation
20. Assignment Sheet #20--Number Words
21. Assignment Sheet #21--Rounding to Nearest Whole Number
22. Assignment Sheet #22--Adding Decimals
23. Assignment Sheet #23--Subtracting Decimals
24. Assignment Sheet #24--Multiplying Decimals
25. Assignment Sheet #25--Dividing a Decimal by a Decimal
26. Assignment Sheet #26--Dividing a Whole Number by a Decimal
27. Assignment Sheet #27--Writing Fractions as Decimals and Percents
28. Assigment Sheet #28--Writing Percents as Fractions and Decimals
29. Assignment Sheet #29--Solving Percent Problems
30. Assignment Sheet #30--Finding the Percent of a Number

31. Assignment Sheet #31--Compute Board Feet

32. Assignment Sheet #32--Compute the Cost of Materials

33. Assignment Sheet #33--Calculate the Amount of Wire Mesh for a Job

34. Assignment Sheet #34--Solve Basic Ratio and Proportion Problems

E. Answers to assignment sheets

F. Test

G. Answers to test

III. Unit references:

A. Olivo, C. Thomas, and Olivo, Thomas P. *Basic Mathematics Simplified*. Albany, New York: Delmar Publishers, 1972.

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D. Bernstein, Allen L., and Wells, David W. *Troubleshooting Mathematics Skills*. New York: Holt, Rinehart, and Winston, Inc., 1969.

E. Mallory, Virgil S.; Skeen, Kenneth C.; and Meserve, Bruce E. *General Mathematics*. Chicago: L. W. Singer Company, Inc., 1960.

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G. Schumacher, Herman G. *Vocational Mathematics: Shop Arithmetic*. South Holland, Illinois: The Goodheart-Wilcox Company, 1954.

H. Lennes, N. J., and Traver, L. R. *The Lennes Essentials of Arithmetic*. Dallas: Laidlaw Brothers, 1964.

I. Nelson, Gilbert D. et al. *General Mathematics for the Shop.* Boston: Houghton Mifflin Company, 1951.

J. Hendrix, Laborn J. "Bud," and Patton, Bob. *Cement Mason's Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1975.

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BASIC MATH
UNIT III

INFORMATION SHEET

I. Terms and definitions

A. Digit--Any one of the ten symbols, 0 to 9, by which all numbers may be expressed

B. Addends--Numbers that are added together

Example: $3 + 5 = 8$ Numbers 3 and 5 are the addends

C. Sum--Answer to an addition problem

Example: $3 + 5 = 8$ Number 8 is the sum

D. Subtraction--Opposite (inverse) operation of addition

E. Minuend--Number from which another number is being subtracted

Example: $10 - 4 = 6$ Number 10 is the minuend

F. Subtrahend--Number which is being subtracted from another number

Example: $10 - 4 = 6$ Number 4 is the subtrahend

G. Difference--Answer to a subtraction problem

Example: $10 - 4 = 6$ Number 6 is the difference

H. Multiplication--Act of multiplying; at its simplest, an abbreviated process of adding an integer to itself a specified number of times

Example: $5 \times 3 = 15$

I. Integer--Any of the natural numbers; whole numbers

J. Factors--Numbers that are multiplied

Example: $2 \times 3 = 6$ Numbers 2 and 3 are the factors

K. Product--Answer to a multiplication problem

Example: $2 \times 3 = 6$ Number 6 is the product

L. Division--Operation that is the opposite of multiplication

Example: $15 \div 3 = 5$

INFORMATION SHEET

M. Dividend--Number to be divided

Example: 15 ÷ 3 = 5 Number 15 is the dividend

N. Divisor--Number by which you divide

Example: 15 ÷ 3 = 5 Number 3 is the divisor

O. Quotient--Answer to a division problem

Example: 15 ÷ 3 = 5 Number 5 is the quotient

P. Remainder--Number left over when division is completed

Example: 15 ÷ 4 = 3 with a remainder of 3

Q. Prime factor--Has no factor except itself and one

Example: 1 x 7 = 7 (prime)

R. Problem--Mathematical proposition

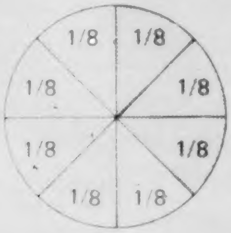
S. Arithmetic--Branch of mathematics that deals with real numbers and computations with these numbers

T. Computation--Act of computing or calculating

U. Calculate--To determine by mathematical process

V. Fraction--Tells what part of a whole thing; represents one or more of the equal parts of a unit

Example: If the unit is divided into eight equal parts, then each part is one-eighth (1/8) of the unit. The fraction three-eighths (3/8) means three of these parts, as shown in the shaded portion of the figure below



W. Numerator--Tells how many equal parts of the whole thing are being considered; top number of the fraction

Example: In the fraction 3/8, the 3 is the numerator

INFORMATION SHEET

X. Denominator--Tells into how many equal parts the whole thing is divided; bottom number of the fraction

Example: In the fraction 3/8, the 8 is the denominator

Y. Decimals--Special fractions whose denominators are numbers like 10, 100, 1,000, or 10,000; not written as common fractions but with the denominator shown by the position of a decimal point

Examples: 1/10 as a decimal = 0.1

6/100 as a decimal = 0.06

3/1000 as a decimal = 0.003

Z. Caret (∧)--Mark made in writing to indicate place where something is to be inserted

AA. Percent (%)--"Per hundred;" division into 100 parts; another way of expressing a fraction whose denominator is 100

Example: 3% = 3 per hundred = 3/100 = 0.03

II. Symbols used in math problems (Transparency 1)

Name of Symbol	Symbol
Addition	+
Subtraction	-
Division	$\div \; \overline{)\quad}$
Multiplication	×
Equal	=
Decimal	.
Percent	%
Caret	∧

III. Addition (Assignment Sheets #1, #2, and #3)

A. Write the numbers one under another with the one's column in a straight line

INFORMATION SHEET

B. Begin by adding on the right

Example:

$$\begin{array}{r} 1420 \\ 15 \\ +123 \\ \hline 1558 \end{array}$$

IV. Subtraction (Assignment Sheets #4 and #5)

A. Minuend is larger than the subtrahend

B. Begin with the one's column and move to the left

Example:

$$\begin{array}{r} 784 \\ -431 \\ \hline 353 \end{array}$$

V. Division (Assignment Sheets #6, #7, and #8)

A. Write the number to be divided as the dividend within the division frame; write the divisor outside

B. Determine how many times the numerals in the first few digits of the dividend may be divided by the divisor

C. Multiply the divisor by the trial quotient

(NOTE: The numeral in the unit's digit of the divisor is multiplied first, then tens, and so on.)

D. Place the product under the dividend

(NOTE: If the trial quotient is larger than it should be, the product will be greater than the dividend. When this happens, change the quotient to the next lower number.)

Example: $1974 \div 6 = 329$

$$\begin{array}{r} 329 \\ 6\overline{)1974} \\ \underline{18} \\ 17 \\ \underline{12} \\ 54 \\ \underline{54} \\ 0 \end{array}$$

VI. Multiplication (Assignment Sheets #9, #10, and #11)

A. Write the larger factor above the smaller factor

(NOTE: Place the numbers in columns, ones in one's column, tens in ten's column, and so on.)

INFORMATION SHEET

B. Multiply the numbers in the one's column; write the one's results in the one's column and carry over the tens

C. Multiply the ten's number in the top number by the one's numeral in the bottom number; add on the carry over

D. Write the first numeral on the right in this result in the ten's column

E. Carry over any numerals representing hundreds and add to the next result

F. Continue to multiply every numeral in the top factor by every numeral in the bottom factor

G. Add the results in each column

Examples: Multiplying by one digit

$4 \times 53 = 212$

$$\begin{array}{r} 53 \\ \times\ 4 \\ \hline 212 \end{array}$$

Multiplying by two digits

$42 \times 174 = 7308$

$$\begin{array}{r} 174 \\ \times\ 42 \\ \hline 348 \\ 696 \\ \hline 7308 \end{array}$$

Multiplying by three digits

$619 \times 825 = 510,675$

$$\begin{array}{r} 825 \\ \times\ 619 \\ \hline 7425 \\ 825 \\ 4950 \\ \hline 510675 \end{array}$$

VII. Parts of a fraction (Assignment Sheet #12)

A. Numerator--Top number

B. Fractional line--Indicates division

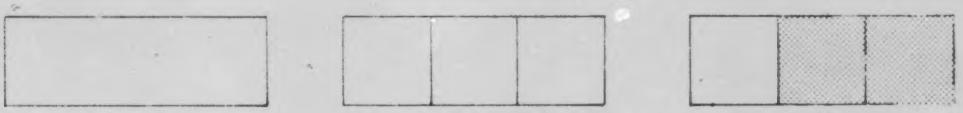
C. Denominator--Bottom number

Example: 3 ← Numerator
— ← Fraction line
4 ← Denominator

INFORMATION SHEET

VIII. Drawing fractions--Fractions can be represented by dividing and shading figures (Assignment Sheet #13)

Example: 2/3



IX. Solving fractional word problems (Assignment Sheet #14)

A. Draw figures to represent all the items

B. Shade the parts being considered

X. Types of fractions (Assignment Sheet #15)

A. Proper--Numerator is smaller than the denominator

Example: 3/9

B. Improper--Numerator is larger than or equal to the denominator

Examples: 8/6, 7/7

C. Mixed--Contains a whole number and a fraction

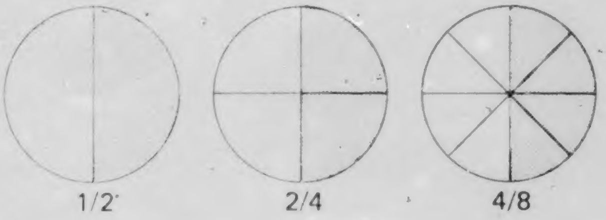
Examples: 9 1/2, 4 2/3, 1 7/8

XI. Fractions which are equivalent to the number one--Fraction in which the numerator and denominator are the same (equal)

Examples: 4/4 = 1, 5/5 = 1, 25/25 = 1

XII. Equivalent fractions--Two or more fractions which look different and are read differently but mean the same part of the whole thing (Assignment Sheet #16)

Example:



(NOTE: All three circles have different names, but all three shaded areas are equal.)

INFORMATION SHEET

XIII. Equivalent fractions with a given denominator (Assignment Sheet #16)

A. Determine by what number the first denominator must be multiplied or divided to get the second denominator

B. Perform the same operation with the same number on the numerator

Examples: $1/4 = x/8;\ 4 \times 2 = 8;\ 1 \times 2 = 2;\ 1/4 = 2/8$

$12/15 = x/5;\ 15 \div 3 = 5;\ 12 \div 3 = 4;\ 12/15 = 4/5$

XIV. Converting mixed numbers to improper fractions--Multiply the denominator of the fraction times the whole number and add the numerator of the fraction (Assignment Sheet #17)

Examples:

$$4\ 3/5 = \frac{(5 \times 4) + 3}{5} = \frac{23}{5}$$

$$7\ 1/2 = \frac{(2 \times 7) + 1}{2} = \frac{15}{2}$$

XV. Converting improper fractions to mixed numbers or whole numbers--Divide the denominator into the numerator and express the remainder as a fraction (Assignment Sheet #17)

Example:

$$\begin{array}{r} 1 \\ 7\overline{)\ 9} \\ \underline{7} \\ 2 \end{array} \quad = \quad 1\ 2/7$$

(NOTE: If the denominator divides into the numerator evenly, then the answer is expressed as a whole number.)

Example: $9/3 = 3$

XVI. Reducing fractions--Divide the numerator and denominator by the same whole number (Assignment Sheet #18)

(NOTE: A fraction is in lowest terms if both the numerator and denominator cannot be divided by the same whole number, except one.)

Examples: 4/6 is not reduced to lowest terms because both the numerator (4) and the denominator (6) can be divided by 2

$4 \div 2 = 2$
$6 \div 2 = 3$

$4/6 = 2/3$

2/3 is reduced because the numerator (2) and the denominator (3) cannot be divided by the same number, except 1

INFORMATION SHEET

XVII. Place value--In the numer 0.487613

A. 4 means 4 tenths

B. 8 means 8 hundredths

C. 7 means 7 thousandths

D. 6 means 6 ten-thousandths

E. 1 means 1 hundred-thousandths

F. 3 means 3 millionths

Example:

		Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
0	.	9	2	7	1	0	5

XVIII. Decimal notation for fractions (Assignment Sheet #19)

A. Fractions with ten or a power of ten as the denominator may be easily written as decimals

B. There will be as many decimal places as zeros in the denominator

C. Place a decimal point in front of the numerator and leave off the denominator

(NOTE: Zeros may be needed as place holders.)

Examples: 1/10 = 0.1; 3/100 = 0.03; 79/100 = 0.79

D. Mixed numbers will be written with the whole number to the left of the decimal point

Examples: 1 1/10 = 1.1; 3 7/100 = 3.07

INFORMATION SHEET

XIX. Number words as decimal numerals (Assignment Sheet #20)

A. Fractions

1. Write out the number

2. Count the number of decimal places for the place value written at the end of the number word

3. Add zeros for place holders

Example: Eight hundred twenty-five ten-thousandths = 0.0825 (ten thousandths = 4 places)

B. Mixed numbers

1. Word *and* or the word *point* indicates the decimal point

2. Number words before *and* or *point* are whole numbers

3. Number words after *and* or *point* are decimal fractions

Examples: Six and one hundred twenty-five thousandths = 6.125

Seven point three eight one = 7.381

XX. Rounding a decimal to a given place (Assignment Sheet #21)

A. Consider the digit in the place immediately to the right of the given place

B. If the digit in the place to the right of the given place is less than 5, drop it and leave the other digits unchanged

C. If the digit in the place to the right of the given place is 5 or greater, drop it but increase the preceding digit by 1

Examples: 5.6 rounded to nearest whole number would be 6

0.52 rounded to nearest tenth would be 0.5

0.377 rounded to hundredths would be 0.38

0.7456 rounded to thousandths would be 0.746

XXI. Adding decimals (Assignment Sheet #22)

A. Write the given numbers in a column with the decimal points directly under each other

B. Add each column of numbers the same as for regular whole numbers

C. Locate the decimal point in the answer by placing it directly under the above decimal points

Example: 0.857 + 2.1 + 370.057 + 753 = 1126.014

0.857	0.857
2.1	2.100
370.057	370.057
+753	+ 753.000
1126.014	1126.014

(NOTE: Zeros can be added so each number has the same amount of decimal places.)

XXII. Subtracting decimals (Assignment Sheet #23)

A. Solving subtraction problems

1. Write the given numbers so that the decimal points are under each other

   (NOTE: Whole numbers, such as 7 or 27, have understood decimal points, such as 7.00 or 27.00.)

2. Subtract each column of numbers the same as for regular whole numbers

3. Locate the decimal point in the answer (difference) by placing it under the above decimal points

B. Checking subtraction problems

1. Add the answer and the number just above it

2. Notice that the sum must be the same as the top number in the problem for the difference to be correct

Example:		Check	
	8.120		1.397
	-1.397		+ 6.723
	6.723		8.120

(NOTE: If you have a whole number, you may add as many zeros to the right of the decimal point as you need.)

XXIII. Multiplying decimals (Assignment Sheet #24)

A. Multiply the same as with whole numbers

(NOTE: In writing the multiplication problems, the decimal points do not have to be in columns.)

B. Total the number of decimal places to the right of the decimal point in the factors being multiplied

INFORMATION SHEET

C. Locate the decimal point by starting at the extreme right digit in the answer and counting off as many places to the left as the total of step B indicates

Examples: Multiply 27.935 by 7.07

$$\begin{array}{rl} 27.935 & \text{3 places} \\ \times \quad 7.07 & \text{2 places} \\ \hline 195545 & \\ 1955450 & \\ \hline 197.50045 & \text{5 places} \end{array}$$

Multiply 2.31 by 0.041

$$\begin{array}{rl} 2.31 & \text{2 places} \\ \times \quad 0.041 & \text{3 places} \\ \hline 231 & \\ 924 & \\ \hline 0.09471 & \text{5 places} \end{array}$$

XXIV. Dividing a decimal by a decimal (Assignment Sheet #25)

A. Count the number of digits to the right of the decimal point in the divisor

B. Place a caret at the end of the number

C. Count as many digits to the right of the decimal point in the dividend as you counted in the divisor

D. Place a caret after the last digit you count

(NOTE: You may need to place some zeros in the dividend to the right of the last digit.)

E. Place the decimal point in the quotient directly above the caret in the dividend

F. Divide as with whole numbers

G. Check by multiplying the quotient and the divisor

Examples:

$$\begin{array}{r} 00.5 \\ 0.5_{\wedge}\overline{)\;0.2_{\wedge}5} \end{array} \quad \text{check} \quad \begin{array}{r} 0.5 \\ \times\, 0.5 \\ \hline 0.25 \end{array}$$

$$\begin{array}{r} 5. \\ 0.05_{\wedge}\overline{)\;0.25_{\wedge}} \end{array} \quad \text{check} \quad \begin{array}{r} 0.05 \\ \times \quad 5 \\ \hline 0.25 \end{array}$$

$$0.005_{\wedge}\overline{)\;0.25} \quad \text{becomes} \quad \begin{array}{r} 50. \\ 0.005_{\wedge}\overline{)\;0.250_{\wedge}} \end{array} \quad \text{check} \quad \begin{array}{r} 0.005 \\ 50 \\ \hline 0.250 \end{array}$$

INFORMATION SHEET

XXV. Dividing a whole number by a decimal (Assignment Sheet #26)

A. Place a decimal point in the dividend at the right side of the number

B. Count the number of digits to the right of the decimal point in the divisor

C. Place a caret at the end of the number

D. Write as many zeros after the decimal point in the dividend as you counted places in the divisor

E. Place a caret after the last zero

F. Place a decimal point in the quotient directly above the caret in the dividend

G. Divide as with whole numbers

(NOTE: Zeros may need to be added beyond the caret if the division does not come out even.)

H. Check by multiplying the divisor and quotient

Example:

$$0.03_{\wedge}\overline{)\,9} \quad \text{becomes} \quad 0.03_{\wedge}\overset{300.}{\overline{)\,9.00_{\wedge}}} \quad \text{check} \quad \begin{array}{r} 300 \\ \times\ 0.03 \\ \hline 9.00 \end{array}$$

XXVI. Writing fractions as decimals and percents (Assignment Sheet #27)

A. Fractions as decimals--Divide the numerator by the denominator

Example: 5/8

$$\begin{array}{r} 0.625 \\ 8\,\overline{)\,5.000} \\ \underline{4\,8} \\ 20 \\ \underline{16} \\ 40 \\ \underline{40} \end{array}$$

B. Fractions as percents

1. Express the fraction in decimal form

2. Move the decimal point two places to the right

INFORMATION SHEET

3. Place the percent symbol (%) after the number

Example: 7/33

```
         .2121     =   0.2121   =   21.21%
  33 )7.0000
      6 6
       40
       33
        70
        66
         40
         33
          7
```

(NOTE: Percent means that some number is being compared to 100.)

XXVII. Writing percents as fractions and decimals (Assignment Sheet #28)

A. Percents as fractions

1. Drop the percent symbol (%)

2. Place the number over 100

(NOTE: Reduce to simplest form.)

Examples:

$$38\% = \frac{38}{100} = \frac{19}{50}$$

$$33\ 1/3 = \frac{33\ 1/3}{100} = \frac{100/3}{100} = 1/3$$

B. Percents as decimals

1. Drop the percent symbol (%)

2. Move the decimal point two places to the left

Examples: 74% = 0.74

33 1/3% = 0.33

XXVIII. Solving percent problems (Assignment Sheets #29 and #30)

A. Write the percent over 100

B. Write the part being considered over the whole amount

C. Write the two fractions with an equal sign between them

INFORMATION SHEET

D. Cross multiply and solve the resulting equation

Examples: 1. 16 is what percent of 80?

$$\frac{n}{100} = \frac{16}{80}$$

$80n = 1600$ (Divide 80 into 1600)

$n = 20\%$

2. 5% of 97.3 is what number?

$$\frac{5}{100} = \frac{n}{97.3}$$

$100n = 486.5$ (Divide 100 into 486.5 or move the decimal point two places to the left)

$n = 4.865$

3. 26 is 40% of what number?

$$\frac{40}{100} = \frac{26}{n}$$

$40n = 2600$ (Divide 40 into 2600)

$n = 65$

XXIX. Sale prices (Assignment Sheet #30)

A. Finding the discount

1. Write the percent over 100
2. Write the amount of discount over the original price
3. Write the two fractions with an equal sign between them
4. Cross multiply and solve the resulting equation

Example: Saw which sells for $50 is on sale at a discount of 10%. How much is being taken off the price?

$$\frac{10}{100} = \frac{n}{50}$$

$100n = 500$

$n = \$5.00$

INFORMATION SHEET

B. Finding the sale price

1. Using the discount

   a. Figure the amount of discount

   b. Subtract the discount from the original price

   Example: In the previous example, the discount is \$5 and the original price is \$50. \$50 - \$5 = \$45 sale price

2. Using the percent

   a. Subtract the percent of discount from 100%

   b. Write this percent over 100

   c. Write the sale price over the original price

   d. Write the two fractions with an equal sign between them

   e. Cross multiply and solve the resulting equation

   Example: Saw that sells for \$50 is on sale at a discount of 10%. What will you have to pay for it?

   Solution:

$$\begin{array}{r} 100\% \\ -10\% \\ \hline 90\% \end{array}$$

$$\frac{90}{100} = \frac{n}{50}$$

$$100n = 4500$$

$$n = \$45.00$$

INFORMATION SHEET

XXX. Decimal and fraction equivalents

Decimal Equivalents

1/64	.015625	33/64	.515625
1/32	.03125	17/32	.53125
3/64	.046875	35/64	.546875
1/16	.0625	9/16	.5625
5/64	.078125	37/64	.578125
3/32	.09375	19/32	.59375
7/64	.109375	39/64	.609375
1/8	.125	5/8	.625
9/64	.140625	41/64	.640625
5/32	.15625	21/32	.65625
11/64	.171875	43/64	.671875
3/16	.1875	11/16	.6875
13/64	.203125	45/64	.703125
7/32	.21875	23/32	.71875
15/64	.234375	47/64	.734375
1/4	.25	3/4	.75
17/64	.265625	49/64	.765625
9/32	.28125	25/32	.78125
19/64	.296875	51/64	.796875
5/16	.3125	13/16	.8125
21/64	.328125	53/64	.828125
11/32	.34375	27/32	.84375
23/64	.359375	55/64	.859375
3/8	.375	7/8	.875
25/64	.390625	57/64	.890625
13/32	.40625	29/32	.90625
27/64	.421875	59/64	.921875
7/16	.4375	15/16	.9375
29/64	.453125	61/64	.953125
15/32	.46875	31/32	.96875
31/64	.484375	63/64	.984375
1/2	.5	1	1.

INFORMATION SHEET

XXXI. Calculate problems dealing with area (Transparency 2)

Length x Width = Area

Examples: Find the area of an object 8" wide and 10" long

8" x 10" = 80 square inches

Find the area of a wall 12' high and 20' long

12' x 20' = 240 square feet

Find the area of a wall 15' 3" high and 21' 9" long

15' 3" = 15.25'

21' 9" = 21.75'

15.25' x 21.75' = 331.6875 or 331.7 square feet

XXXII. Figuring board feet (Transparency 3, Assignment Sheet #31)

$$\frac{\text{Number of Pieces} \times \text{Thickness in Inches} \times \text{Width in Inches} \times \text{Length in Feet}}{12}$$

Example: Three boards, one inch thick by six inches wide by ten feet long

$$\frac{3 \times 1'' \times 6'' \times 10'}{12} = \frac{180}{12} = 15 \text{ board feet}$$

(NOTE: The answer will be incorrect if it is not labeled board feet.)

XXXIII. Computing board feet and cost (Transparency 4, Assignment Sheets #31 and #32)

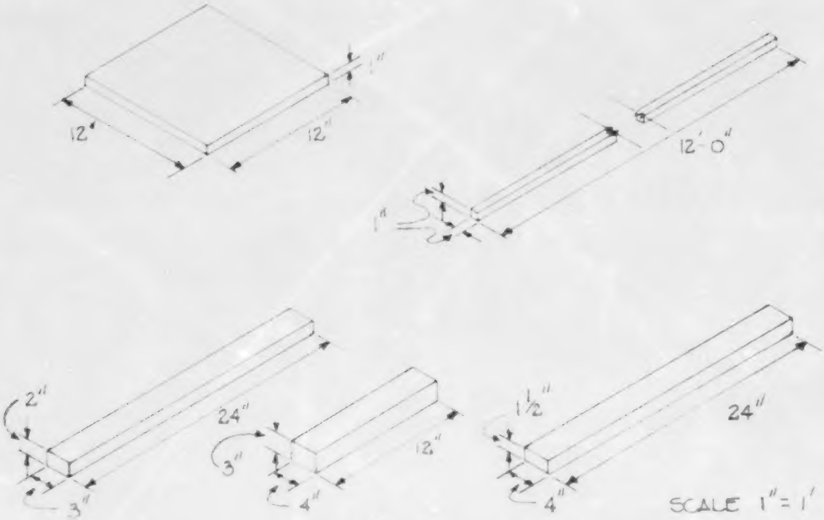
A. Lumber sizes used in figuring board feet are the nominal sizes; lumber less than 1" thick is figured as 1 inch

Example: Piece 1/2" x 12' x 12" is considered as one board foot. Lengths are usually in even feet under twenty-four feet; lumber over twenty-four feet can be obtained upon specification

INFORMATION SHEET

B. Unit of measure for lumber is board foot

(NOTE: Each of the illustrations is one board foot.)



C. Pricing of lumber

1. Per board foot

2. Per 100 board feet

   (NOTE: Per hundred board feet is abbreviated as *per C*.)

3. Per 1000 board feet

   (NOTE: Per thousand board feet is abbreviated as *per M*.)

(NOTE: Fractional board feet are not used. Round up to the nearest board foot.)

Examples: 1 1/3 board feet is called 2 board feet

1 3/4 board feet is called 2 board feet

3 1/2 board feet is called 4 board feet

XXXIV. Formula for estimating concrete (Transparency 5)

$$\frac{\text{Width in Feet} \times \text{Length in Feet} \times \text{Thickness in Feet}}{27} = \text{Cubic Yards of Concrete}$$

(NOTE: Thickness quite often being in inches, this has to be broken down by using fractions or decimals.)

INFORMATION SHEET

Examples using a fraction:

$$\frac{30' \times 60' \times 4''}{27} = \frac{30' \times 60' \times 4'' \text{ or } 1/3'}{27} = 22.22 \text{ cubic yards}$$

Example using a decimal:

$$\frac{30' \times 60' \times 0.33'}{27} = \frac{594}{27} = 22 \text{ cubic yards}$$

XXXV. Procedure for estimating wire mesh (Assignment Sheet #33)

A. Mesh roll size

1. 5' x 150'

2. 750 square feet

B. Calculate linear feet

(NOTE: Remember each row must be lapped at least six inches.)

XXXVI. Ratio and proportion as related to concrete (Transparency 6, Assignment Sheet #34)

A. Ratio--Indicates parts of material per mix

Example: 1 : 1 : 3 ratio means 1 part Portland cement, 1 part hydrated lime and 3 parts sand

B. Proportion--Indicates the ratio is the same but the quantity may be different

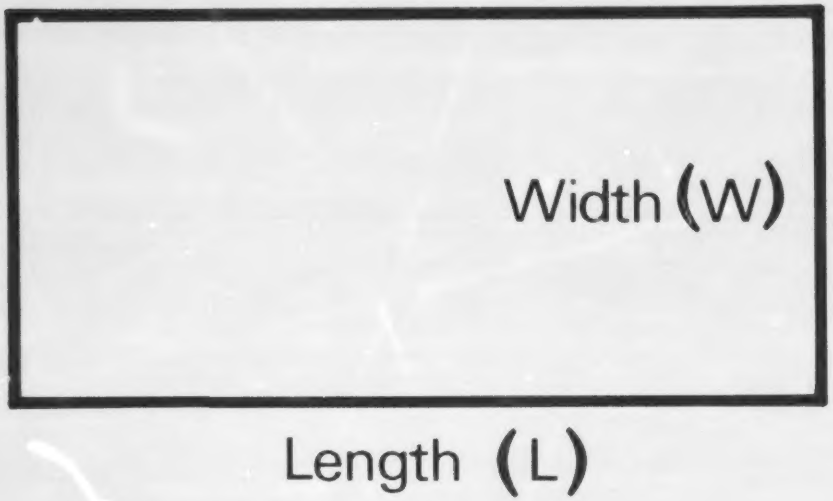
Example: 1 : 1 : 3 = 0.5 : 0.5 : 1.5 indicates the same mix but in different volumes

Math Symbols

Addition	+	Equal	=
Subtraction	–	Decimal	•
Division	÷ $\overline{)}$	Percent	%
Multiplication	x	Caret	^

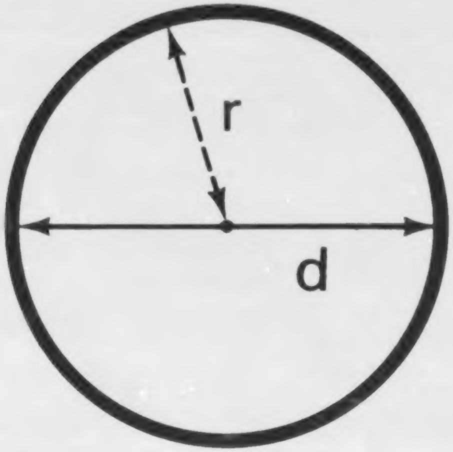
Area

SQUARE or RECTANGLE


Width (W)
Length (L)

Length X Width = Area

CIRCLE



$\pi = 3.1416$

$r = \frac{\text{diameter}}{2}$

πr^2 = area of circle

Formula For Board Feet

$$\frac{N \times T \times W \times L}{12} = \text{Board Feet}$$

N= Number of Pieces
T= Thickness in Inches
W= Width in Inches
L= Length in Feet

Ordering Lumber

Yard Lumber

Number of Pieces	Thickness	Width	Length	Grade	Species	Drying
6 -	2″ x	4″ x	14′	utility,	fir,	KD
4 -	1″ x	8″ x	16′	economy,	fir,	KD

Plywood

Number of Pieces	Thickness	Width	Length	Grade	Species	Interior/Exterior
4 sheets	3/4″ x	4′ x	8′	AB,	fir,	INT
2 sheets	1/4″ x	4′ x	8′	AC,	fir,	EXT

Formula For Estimating Concrete

$$\frac{\begin{array}{l}\text{Width in Feet}\\ \times\ \text{Length in Feet}\\ \times\ \text{Thickness in Feet}\end{array}}{27} = \begin{array}{l}\text{Cubic Yards}\\ \text{of Concrete}\end{array}$$

Ratio and Proportion

1:1:3 = ratio of cement, lime, and sand mixed in mortar

0.5:0.5:1.5 = proportion of ratio 1:1:3 cut in half

TM 6

BASIC MATH
UNIT III

ASSIGNMENT SHEET #1--THE 100 ADDITION COMBINATIONS

Add the following combinations.

1.	7	2	2	2	4	4	3
	1	9	5	8	4	1	1
	4	1	9	7	2	6	5
	0	8	9	7	0	1	4
	3	1	9	8	1	1	
	3	1	2	8	3	6	
2.	1	2	0	5	2	0	7
	7	1	0	5	2	1	2
	1	0	8	6	0	3	0
	9	5	1	2	4	6	2
	2	3	4	0	6	8	
	4	0	5	8	0	3	
3.	8	6	1	9	5	6	3
	2	4	4	1	0	6	2
	4	1	9	2	9	0	6
	3	5	0	6	3	6	5
	3	3	3	2	3	6	
	8	4	9	3	5	3	

ASSIGNMENT SHEET #1

$$\begin{array}{llllllll}
4. & 7 & 2 & 8 & 4 & 8 & 1 & 5 \\
 & \underline{3} & \underline{7} & \underline{7} & \underline{8} & \underline{0} & \underline{0} & \underline{2}
\end{array}$$

$$\begin{array}{llllllll}
 & 4 & 1 & 5 & 0 & 0 & 5 & 7 \\
 & \underline{2} & \underline{2} & \underline{3} & \underline{3} & \underline{9} & \underline{1} & \underline{0}
\end{array}$$

$$\begin{array}{lllllll}
 & 8 & 7 & 5 & 9 & 6 & 6 \\
 & \underline{5} & \underline{9} & \underline{8} & \underline{7} & \underline{8} & \underline{9}
\end{array}$$

$$\begin{array}{llllllll}
5. & 5 & 7 & 8 & 9 & 5 & 8 & 8 \\
 & \underline{7} & \underline{8} & \underline{4} & \underline{6} & \underline{9} & \underline{9} & \underline{6}
\end{array}$$

$$\begin{array}{llllllll}
 & 4 & 7 & 4 & 9 & 9 & 6 & 0 \\
 & \underline{7} & \underline{5} & \underline{9} & \underline{5} & \underline{4} & \underline{7} & \underline{7}
\end{array}$$

$$\begin{array}{lllllll}
 & 5 & 4 & 7 & 7 & 9 & 3 \\
 & \underline{6} & \underline{6} & \underline{6} & \underline{4} & \underline{8} & \underline{7}
\end{array}$$

BASIC MATH
UNIT III

ASSIGNMENT SHEET #2--TWO-DIGIT NUMBERS

Add the following two digit numbers.

1.	49 81 27	37 74 66	92 38 77	87 26 44	44 57 63
2.	28 41 82	36 81 74	67 38 43	64 78 32	72 38 25
3.	72 38 25	87 29 41	26 17 84	38 29 72	41 59 67
4.	82 78 32 18 96 54	47 63 82 28 99 51	74 36 45 87 23 45	18 92 47 63 93 27	75 48 35 62 51 48
5.	17 23 36 45 82 90 41	57 63 92 83 45 67 32	13 93 62 56 98 87 60	39 46 72 53 40 79 81	32 87 40 79 53 62 81

BASIC MATH
UNIT III

ASSIGNMENT SHEET #3--THREE-DIGIT NUMBERS

1. Add:

a.	b.	c.	d.
576	333	747	342
953	478	324	636
462	962	600	877
615	510	598	965

e.	f.	g.	h.
396	923	327	270
728	934	240	368
220	966	136	609
494	123	238	224

2. Solve the following problems:

   a. In a certain house, a builder applied 528 square feet of gypsum wall board in the kitchen, 640 square feet in the living room and 580 square feet in the dining room. How many square feet did the builder apply?

ASSIGNMENT SHEET #3

b. In estimating the finished flooring for a house, a contractor listed the room areas as follows: living room, 168 square feet; bedroom, 152 square feet; hall, 45 square feet; and kitchen, 125 square feet. What was the total area to be floored?

c. For building a house, the following items of framing timber were ordered: 472 board feet of 2 x 4 studs; 987 board feet of 2 x 10 joists; 827 board feet of 2 x 6 stock; 723 board feet of 2 x 8 stock. How many board feet of framing timber were ordered?

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BASIC MATH
UNIT III

ASSIGNMENT SHEET #4--THE 100 SUBTRACTION COMBINATIONS

Subtract the following combinations.

1.	6	2	5	6	3	7	4
	1	1	2	3	1	1	3
	5	8	6	9	4	9	9
	5	4	5	8	4	1	9
	5	5	1	8	4	6	
	3	4	1	1	2	6	
2.	3	3	7	5	0	3	5
	3	2	7	1	0	0	0
	9	8	10	8	9	7	6
	6	2	4	8	3	3	0
	9	7	12	10	8	11	
	0	2	6	7	6	2	
3.	6	10	10	10	7	9	8
	2	9	1	2	6	5	7
	4	2	7	6	8	13	15
	1	2	5	4	5	6	8
	11	11	11	9	10	14	
	7	5	8	2	3	7	

ASSIGNMENT SHEET #4

4.	7	10	12	12	1	8	7
	4	8	4	8	0	3	0
	12	10	10	8	2	15	12
	9	5	6	0	0	9	3
	4	14	13	16	14	17	
	0	9	4	9	5	9	
5.	9	17	15	13	13	16	13
	7	8	7	9	5	7	7
	13	11	14	9	15	12	14
	8	3	6	4	6	5	8
	12	11	11	16	18	11	
	7	4	6	8	9	9	

BASIC MATH
UNIT III

ASSIGNMENT SHEET #5--TWO-, THREE-, AND FOUR DIGIT NUMBERS

Subtract the following combinations.

1. $\begin{array}{r} 75 \\ \underline{56} \end{array}$ 2. $\begin{array}{r} 84 \\ \underline{57} \end{array}$ 3. $\begin{array}{r} 4635 \\ \underline{3187} \end{array}$ 4. $\begin{array}{r} 4178 \\ \underline{1539} \end{array}$

5. $\begin{array}{r} 218 \\ \underline{119} \end{array}$ 6. $\begin{array}{r} 983 \\ \underline{656} \end{array}$ 7. $\begin{array}{r} 771 \\ \underline{289} \end{array}$ 8. $\begin{array}{r} 53 \\ \underline{39} \end{array}$

9. $\begin{array}{r} 74 \\ \underline{26} \end{array}$ 10. $\begin{array}{r} 62 \\ \underline{29} \end{array}$ 11. $\begin{array}{r} 77 \\ \underline{39} \end{array}$ 12. $\begin{array}{r} 123 \\ \underline{67} \end{array}$

13. $\begin{array}{r} 111 \\ \underline{79} \end{array}$ 14. $\begin{array}{r} 204 \\ \underline{78} \end{array}$ 15. $\begin{array}{r} 356 \\ \underline{178} \end{array}$ 16. $\begin{array}{r} 378 \\ \underline{179} \end{array}$

17. $\begin{array}{r} 4890 \\ \underline{362} \end{array}$ 18. $\begin{array}{r} 365 \\ \underline{209} \end{array}$ 19. $\begin{array}{r} 6720 \\ \underline{4890} \end{array}$ 20. $\begin{array}{r} 7650 \\ \underline{2312} \end{array}$

BASIC MATH
UNIT III

ASSIGNMENT SHEET #6--ONE-DIGIT DIVISOR

Solve the following division problems.

1. $3\overline{)6}$
2. $7\overline{)21}$
3. $5\overline{)225}$
4. $6\overline{)3600}$
5. $5\overline{)5}$
6. $4\overline{)16}$
7. $3\overline{)18}$
8. $9\overline{)81}$
9. $2\overline{)624}$
10. $8\overline{)4080}$
11. $9\overline{)108}$
12. $8\overline{)136}$
13. $7\overline{)49}$
14. $3\overline{)813}$
15. $4\overline{)48}$
16. $3\overline{)750}$
17. $5\overline{)830}$
18. $2\overline{)6704}$
19. $3\overline{)1206}$
20. $9\overline{)279}$

BASIC MATH
UNIT III

ASSIGNMENT SHEET #7--TWO-DIGIT DIVISOR

1. $12\overline{)\,24}$
2. $30\overline{)\,90}$
3. $66\overline{)\,198}$
4. $15\overline{)\,60}$
5. $23\overline{)\,276}$
6. $19\overline{)\,152}$
7. $86\overline{)\,1032}$
8. $11\overline{)\,121}$
9. $35\overline{)\,1225}$
10. $52\overline{)\,468}$
11. $73\overline{)\,1095}$
12. $20\overline{)\,400}$
13. $47\overline{)\,1175}$
14. $79\overline{)\,632}$
15. $99\overline{)\,396}$

BASIC MATH
UNIT III

ASSIGNMENT SHEET #8--TWO- AND THREE-DIGIT DIVISORS

Solve the following division problems.

1. $29\overline{)\ 8507}$
2. $62\overline{)\ 7739}$
3. $28\overline{)\ 5212}$
4. $34\overline{)\ 5950}$
5. $17\overline{)\ 8364}$
6. $71\overline{)\ 18,318}$
7. $43\overline{)\ 10,965}$
8. $56\overline{)\ 7616}$
9. $92\overline{)\ 30,084}$

ASSIGNMENT SHEET #8

10. $37\overline{)\,26,679}$

11. $7\overline{)\,4228}$

12. $15\overline{)\,24,090}$

13. $15\overline{)\,4530}$

14. $26\overline{)\,52,260}$

15. $13\overline{)\,91,169}$

16. $34\overline{)\,17,238}$

17. $36\overline{)\,10,080}$

18. $17\overline{)\,53,040}$

ASSIGNMENT SHEET #8

19. $321\overline{)\,110{,}424}$

20. $417\overline{)\,12{,}093}$

21. $558\overline{)\,65{,}844}$

22. $713\overline{)\,161{,}149}$

23. $308\overline{)\,165{,}432}$

BASIC MATH
UNIT III

ASSIGNMENT SHEET #9--MULTIPLICATION FACTS

Find the products of the following multiplication problems.

1.

$$\begin{array}{ccccccc} 6 & 0 & 3 & 0 & 2 & 3 & 4 \\ \underline{2} & \underline{4} & \underline{6} & \underline{2} & \underline{4} & \underline{0} & \underline{5} \end{array}$$

$$\begin{array}{ccccccc} 0 & 6 & 8 & 8 & 6 & 1 & 9 \\ \underline{8} & \underline{0} & \underline{3} & \underline{2} & \underline{4} & \underline{4} & \underline{1} \end{array}$$

$$\begin{array}{cccccc} 5 & 6 & 3 & 4 & 1 & 9 \\ \underline{0} & \underline{6} & \underline{2} & \underline{3} & \underline{5} & \underline{0} \end{array}$$

2.

$$\begin{array}{ccccccc} 2 & 9 & 0 & 6 & 3 & 3 & 3 \\ \underline{6} & \underline{3} & \underline{6} & \underline{5} & \underline{8} & \underline{4} & \underline{9} \end{array}$$

$$\begin{array}{ccccccc} 2 & 3 & 6 & 7 & 2 & 8 & 4 \\ \underline{3} & \underline{5} & \underline{3} & \underline{3} & \underline{7} & \underline{7} & \underline{8} \end{array}$$

$$\begin{array}{cccccc} 8 & 1 & 5 & 4 & 1 & 5 \\ \underline{0} & \underline{0} & \underline{2} & \underline{2} & \underline{2} & \underline{3} \end{array}$$

3.

$$\begin{array}{ccccccc} 0 & 0 & 5 & 7 & 8 & 7 & 5 \\ \underline{3} & \underline{9} & \underline{1} & \underline{0} & \underline{5} & \underline{9} & \underline{8} \end{array}$$

$$\begin{array}{ccccccc} 9 & 6 & 6 & 7 & 2 & 2 & 2 \\ \underline{7} & \underline{8} & \underline{9} & \underline{1} & \underline{9} & \underline{5} & \underline{8} \end{array}$$

$$\begin{array}{cccccc} 4 & 4 & 3 & 4 & 1 & 9 \\ \underline{4} & \underline{1} & \underline{1} & \underline{0} & \underline{8} & \underline{9} \end{array}$$

ASSIGNMENT SHEET #9

4. $\begin{array}{r}7\\ \underline{7}\end{array}$ $\begin{array}{r}2\\ \underline{0}\end{array}$ $\begin{array}{r}6\\ \underline{1}\end{array}$ $\begin{array}{r}5\\ \underline{4}\end{array}$ $\begin{array}{r}3\\ \underline{3}\end{array}$ $\begin{array}{r}1\\ \underline{1}\end{array}$ $\begin{array}{r}9\\ \underline{2}\end{array}$

$\begin{array}{r}8\\ \underline{8}\end{array}$ $\begin{array}{r}1\\ \underline{3}\end{array}$ $\begin{array}{r}1\\ \underline{6}\end{array}$ $\begin{array}{r}1\\ \underline{7}\end{array}$ $\begin{array}{r}2\\ \underline{1}\end{array}$ $\begin{array}{r}0\\ \underline{0}\end{array}$ $\begin{array}{r}5\\ \underline{5}\end{array}$

$\begin{array}{r}2\\ \underline{2}\end{array}$ $\begin{array}{r}0\\ \underline{1}\end{array}$ $\begin{array}{r}7\\ \underline{2}\end{array}$ $\begin{array}{r}1\\ \underline{9}\end{array}$ $\begin{array}{r}0\\ \underline{5}\end{array}$ $\begin{array}{r}8\\ \underline{1}\end{array}$

5. $\begin{array}{r}9\\ \underline{5}\end{array}$ $\begin{array}{r}9\\ \underline{4}\end{array}$ $\begin{array}{r}6\\ \underline{7}\end{array}$ $\begin{array}{r}0\\ \underline{7}\end{array}$ $\begin{array}{r}5\\ \underline{6}\end{array}$ $\begin{array}{r}4\\ \underline{6}\end{array}$ $\begin{array}{r}7\\ \underline{6}\end{array}$

$\begin{array}{r}7\\ \underline{4}\end{array}$ $\begin{array}{r}9\\ \underline{8}\end{array}$ $\begin{array}{r}3\\ \underline{7}\end{array}$ $\begin{array}{r}5\\ \underline{7}\end{array}$ $\begin{array}{r}7\\ \underline{8}\end{array}$ $\begin{array}{r}8\\ \underline{4}\end{array}$ $\begin{array}{r}9\\ \underline{6}\end{array}$

$\begin{array}{r}5\\ \underline{9}\end{array}$ $\begin{array}{r}8\\ \underline{9}\end{array}$ $\begin{array}{r}8\\ \underline{6}\end{array}$ $\begin{array}{r}4\\ \underline{7}\end{array}$ $\begin{array}{r}7\\ \underline{5}\end{array}$ $\begin{array}{r}4\\ \underline{9}\end{array}$

BASIC MATH
UNIT III

ASSIGNMENT SHEET #10--MULTIPLYING BY A ONE-DIGIT FACTOR

Find the products of the following multiplication problems.

1.	$\begin{array}{r}53\\ \underline{4}\end{array}$	$\begin{array}{r}32\\ \underline{3}\end{array}$	$\begin{array}{r}26\\ \underline{4}\end{array}$	$\begin{array}{r}41\\ \underline{8}\end{array}$	$\begin{array}{r}57\\ \underline{4}\end{array}$
2.	$\begin{array}{r}342\\ \underline{2}\end{array}$	$\begin{array}{r}453\\ \underline{5}\end{array}$	$\begin{array}{r}156\\ \underline{4}\end{array}$	$\begin{array}{r}703\\ \underline{5}\end{array}$	$\begin{array}{r}659\\ \underline{3}\end{array}$
3.	$\begin{array}{r}3245\\ \underline{6}\end{array}$	$\begin{array}{r}1203\\ \underline{3}\end{array}$	$\begin{array}{r}2421\\ \underline{4}\end{array}$	$\begin{array}{r}5103\\ \underline{5}\end{array}$	$\begin{array}{r}4356\\ \underline{7}\end{array}$
4.	$\begin{array}{r}481\\ \underline{7}\end{array}$	$\begin{array}{r}3758\\ \underline{6}\end{array}$	$\begin{array}{r}4256\\ \underline{4}\end{array}$	$\begin{array}{r}908\\ \underline{6}\end{array}$	$\begin{array}{r}3497\\ \underline{9}\end{array}$

BASIC MATH
UNIT III

ASSIGNMENT SHEET #11--MULTIPLYING BY A TWO-DIGIT FACTOR

Find the product of each of the following multiplication problems.

1.	63	85	32	42	73	54
	38	26	52	46	64	83
2.	35	95	67	64	82	92
	74	54	43	27	37	67
3.	56	43	62	67	79	89
	54	79	92	85	29	45
4.	79	86	89	76	57	43
	86	68	59	36	73	98

BASIC MATH
UNIT III

ASSIGNMENT SHEET #12--PARTS OF A FRACTION

1. In the following fractions identify the numerator and denominator of each by filling in the blanks.

   a. In the fraction 5/7, the numerator is _____ and the denominator is _______.

   b. In the fraction 8/18, 8 is the ______________ and 18 is the ______________.

   c. In the fraction 1/3, what is the numerator? _______ denominator? ________.

2. Write fractions which fit the following statements.

   a. A fraction with a denominator of 17 and numerator of 10.

   b. A fraction with a numerator of 16 and a denominator of 37.

3. A man cuts a pie into 8 equal pieces and then eats 1 of the 8 pieces.

   a. Which number represents the numerator?

   b. Which number represents the denominator?

   c. What fractional part of the pie did the man eat?

BASIC MATH
UNIT III

ASSIGNMENT SHEET #13--FRACTIONAL PARTS

1. Match the fractions with the correctly shaded figures. There are more figures than there are fractions.

______a. 4/8
______b. 2/2
______c. 6/16
______d. 3/7
______e. 5/5
______f. 1/2
______g. 2/7
______h. 5/6
______i. 1/4
______j. 2/3
______k. 7/8
______l. 3/5
______m. 2/8
______n. 3/3
______o. 1/5

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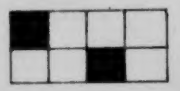

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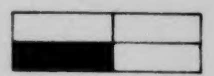

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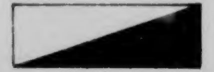

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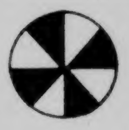

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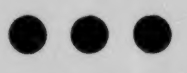

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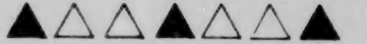

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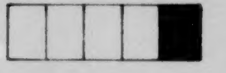

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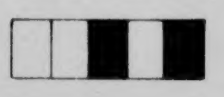

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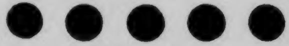

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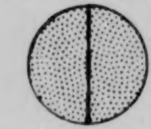

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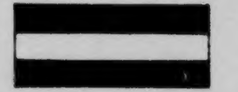

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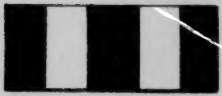

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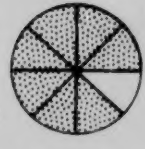

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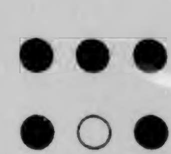

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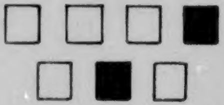

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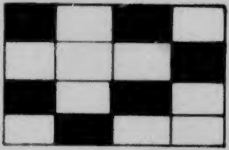
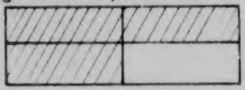


ASSIGNMENT SHEET #13

2. Draw a suitable figure to represent each of the following fractions.

Example: 3/4



a. 1/2

b. 3/4

c. 2/3

d. 1/4

e. 7/8

f. 5/16

g. 3/3

h. 2/4

i. 3/8

j. 13/16

BASIC MATH
UNIT III

ASSIGNMENT SHEET #14--FRACTIONAL WORD PROBLEMS

For each problem below, write the correct fraction and draw a figure which represents the fraction.

1. Mrs. Meade baked a cake in which 5 eggs were used. What part of a dozen eggs were used?

   a.

   b.

2. Mitch was given 8 tickets to sell for the sophomore dance but only sold 3 of them. What fractional part of the tickets did he sell?

   a.

   b.

3. A foot has 12 inches. What fractional part of a foot is 10 inches?

   a.

   b.

4. A dollar contains 4 quarters. What fractional part of a dollar is 1 quarter?

   a.

   b.

5. A $5 bill contains five $1 bills. What fractional part of a $5 bill is $4?

   a.

   b.

BASIC MATH
UNIT III

ASSIGNMENT SHEET #15--TYPES OF FRACTIONS

1. Classify the following numbers by placing "P" for proper fraction, "I" for improper fraction, or "M" for mixed number in the blank to the left.

______a. 1/2

______b. 7/8

______c. 16/2

______d. 3 1/8

______e. 1/4

______f. 1/1

______g. 7/3

______h. 8 1/3

______i. 4/4

______j. 9 3/3

______k. 5 1/2

______l. 9/8

______m. 9/9

______n. 1/7

______o. 16 4/4

2. Use the indicated denominators and furnish numerators to complete the following problems.

   a. Complete these to make proper fractions.

      1) ______/8

      2) ______/10

      3) ______/7

      4) ______/2

      5) ______/30

   b. Complete these to make improper fractions.

      1) ______/3

      2) ______/5

      3) ______/6

      4) ______/9

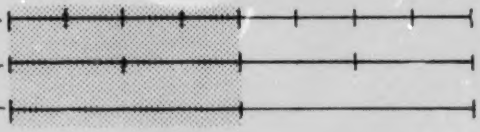
      5) ______/4

BASIC MATH
UNIT III

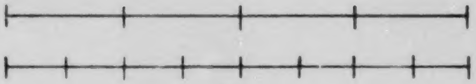
ASSIGNMENT SHEET #16--EQUIVALENT FRACTIONS

1. Illustrate each set of fractions.

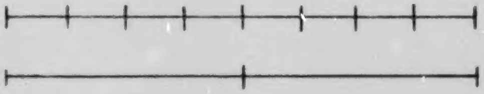
Example: 4/8, 2/4, 1/2



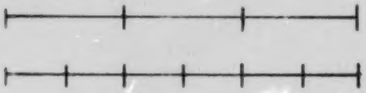
a. 1/4, 2/8



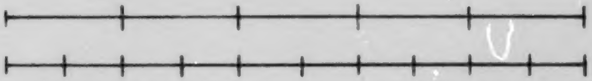
b. 4/8, 1/2



c. 1/3, 2/6



d. 2/5, 4/10



2. Change each of the following fractions to a new fraction with the indicated denominator.

Example: 1/5 = _____/25   1/5 x 5/5 = 5/25

a. 1/2 = _____/4

b. 3/5 = _____/25

c. 30/5 = _____/1

d. 4/4 = _____/1

e. 3/8 = _____/24

f. 33/36 = _____/12

g. 5/7 = _____/14

h. 15/24 = _____/8

i. 14/21 = _____/3

j. 10/11 = _____/121

BASIC MATH
UNIT III

ASSIGNMENT SHEET #17--FRACTION CONVERSION

1. Convert each of the following mixed numbers to improper fractions. (Do not worry about reducing answers to lowest terms at this time.)

a. 3 1/4 =
b. 4 1/2 =
c. 7 1/3 =
d. 8 1/2 =
e. 6 2/3 =
f. 5 1/5 =
g. 4 2/3 =
h. 8 1/7 =
i. 9 1/5 =
j. 16 2/3 =
k. 2 1/2 =
l. 3 2/4 =
m. 7 3/4 =
n. 9 2/3 =
o. 5 2/3 =
p. 6 1/8 =
q. 3 3/4 =
r. 6 4/5 =
s. 4 1/3 =
t. 1 4/5 =

2. Convert each of the following improper fractions to mixed numbers. (Do not worry about reducing answers to lowest terms at this time.)

a. 16/5 =
b. 12/5 =
c. 17/3 =
d. 8/3 =
e. 9/2 =
f. 5/3 =
g. 7/2 =
h. 9/4 =
i. 17/16 =
j. 11/5 =
k. 19/13 =
l. 8/7 =
m. 75/32 =
n. 24/17 =
o. 13/9 =
p. 7/4 =
q. 9/6 =
r. 4/3 =
s. 15/4 =
t. 16/7 =

BASIC MATH
UNIT III

ASSIGNMENT SHEET #18--REDUCING FRACTIONS

Reduce the following fractions to lowest terms.

1. 3/9 =
2. 8/24 =
3. 10/15 =
4. 15/25 =
5. 12/48 =
6. 9/24 =
7. 5/7 =
8. 2/4 =
9. 9/12 =
10. 50/100 =
11. 5/5 =
12. 8/12 =
13. 7/21 =
14. 4/8 =
15. 10/12 =
16. 26/52 =
17. 6/9 =
18. 13/39 =
19. 9/9 =
20. 12/16 =

BASIC MATH
UNIT III

ASSIGNMENT SHEET #19--DECIMAL NOTATION

1. Match the decimal notations on the right to the correct equivalent fractions.

______a.	5 6/10	1. 7.83
______b.	1 2/100	2. 5.006
______c.	87/1000	3. 78.3
______d.	7 83/100	4. 0.087
______e.	5 6/100	5. 0.783
______f.	5 6/1000	6. 87.7
______g.	78 3/10	7. 5.6
______h.	87 7/10	8. 102.0
______i.	102	9. 5.06
______j.	783/100	10. 1.02

2. Write the numbers in decimal notation for each of the following.

a. 63 9/10 =

b. 5 93/100 =

c. 5 93/1000 =

d. 5 93/10,000 =

e. 3 825/1000 =

f. 38 95/100 =

g. 38 95/1000 =

h. 42 3/10 =

i. 402 3/10 =

j. 897 97/100,000 =

k. 96/100 =

BASIC MATH
UNIT III

ASSIGNMENT SHEET #20--NUMBER WORDS

Write each of the following number words as decimal numerals.

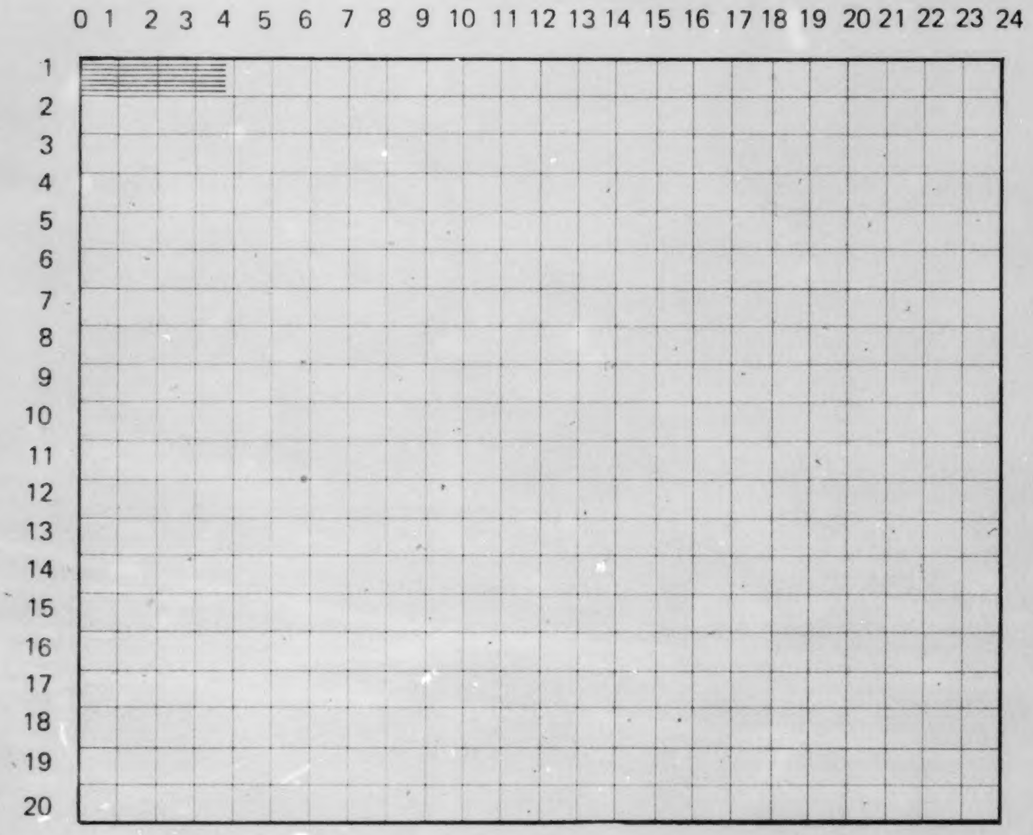
1. Five and seven tenths
2. Five and seventy-five hundredths
3. Five and seven hundred fifty-six thousandths
4. Seven hundred and fifty-six hundredths
5. Five hundred and five hundredths
6. Eight thousand and eight thousandths
7. Ninety-nine and ninety-nine hundredths
8. Forty-one thousand and forty-one thousandths
9. Ten thousand and one ten-thousandth
10. Fourteen thousand six and sixty-six hundredths
11. Three hundred eighty-seven thousandths
12. One thousand twenty-five ten thousandths
13. Twenty-four and six hundred three thousandths
14. Fourteen and two hundredths
15. Sixty-five hundred thousandths
16. Twenty-three and six ten-thousandths
17. Seventy-five millionths
18. Six hundred sixty-six hundred-thousandths
19. Ninety-seven ten-thousandths
20. Thirty-nine and two hundredths

BASIC MATH
UNIT III

ASSIGNMENT SHEET #21--ROUNDING TO NEAREST WHOLE NUMBER

Shade the columns as in problem one and then round the following numbers to the nearest whole number.

1. 3.7 =
2. 1.4 =
3. 2.57 =
4. 2.508 =
5. 9.3451 =
6. 5.5 =
7. 6.0 =
8. 7.19 =
9. 8.359 =
10. 22.4731 =
11. 18.9 =
12. 20.356 =
13. 17.752 =
14. 6.346 =
15. 12.815 =
16. 15.7 =
17. 22.63 =
18. 8.691 =
19. 18.98 =
20. 4.34 =


0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

BASIC MATH
UNIT III

ASSIGNMENT SHEET #22--ADDING DECIMALS

Add each column of numbers, carrying when necessary. Place a decimal point in the sum directly under the above decimal points.

Examples:
0.26
0.168
0.428

4.607
.408
5.015

1. 0.024
0.165

2. 0.873
0.199

3. 4.6
4.62

4. 0.0003
0.0099

5. 5.00
0.99

6. 4.5
0.008

7. 62.14
8.87

8. 3.487
9.645

9. 0.5
0.6
8.3

10. 195.7
83.
9.006

11. 21.5
18.9
32.8

12. 0.0131
0.1640
0.2229

13. 8.69
3.07
17.50

14. 4.612
0.958
0.885

15. 5.29
4.38
9.62

16. 72.24
16.38
92.37

17. 1986.45
312.45
1000.98

18. 4937.23
4980.47
10234.97
9872.54

19. 0.52802
0.34007
0.00321
0.00009

20. 15.125
4.625
20.125
16.125

BASIC MATH
UNIT III

ASSIGNMENT SHEET #23--SUBTRACTING DECIMALS

Rewrite these problems in column form. Subtract and check your work.

1. 868.87 - 516.89 =
2. 567 - 19.856 =
3. 198 - 56.987 =
4. 567.94 - 59.78 =
5. $815.23 - $65.98 =
6. $20.03 - $15.88 =
7. 694.7 - 24.3 =
8. 5,000 - 892.66 =
9. $15 - $12.53 =
10. 219.3 - 0.085 =
11. 16.78 - 5.99 =
12. 1.6 - 0.9453 =
13. 2.345 - 1.6 =
14. 0.13 - 0.023 =
15. 0.00754 - 0.00093 =
16. 20.32 - 0.84 =
17. 930 - 17.45 =
18 0.034 - 0.034 =
19. 1 - 0.9999 =
20. 7.777 - 0.777 =

BASIC MATH
UNIT III

ASSIGNMENT SHEET #24--MULTIPLYING DECIMALS

Rewrite in column form and multiply these problems. Locate the decimal point in the product.

1. 2.64 x 3.1 =
2. 120 x 0.33 =
3. 2.25 x 0.51 =
4. 35 x 8.5 =
5. 26.4 x 3.8 =
6. 7.02 x 0.92 =
7. 0.83 x 0.55 =
8. 28.2 x 0.9 =
9. 0.069 x 0.01 =
10. 7.52 x 3.01 =
11. 32.1 x 29.9 =
12. 0.168 x 12 =
13. 78 x 9.1 =
14. 69.3 x 0.75 =
15. 0.043 x 2.4 =
16. 574 x 0.34 =
17. 10.52 x 0.54 =
18. 9.06 x 4.3 =
19. 21.6 x 0.3 =
20. 60.1 x 8.2 =

BASIC MATH
UNIT III

ASSIGNMENT SHEET #25--DIVIDING A DECIMAL BY A DECIMAL

Divide the following problems. Show your work. Check your answers.

1. 4.5 ÷ 0.5 =
2. 4.96 ÷ 0.4 =
3. 19.8 ÷ 0.6 =
4. 10.71 ÷ 0.07 =
5. 0.225 ÷ 0.15 =
6. 1.7608 ÷ 0.0062 =
7. 0.48 ÷ 0.6 =
8. 0.125 ÷ 0.25 =
9. 0.9 ÷ 0.003 =
10. 1.16 ÷ 2.9 =

BASIC MATH
UNIT III

ASSIGNMENT SHEET #26--DIVIDING A WHOLE NUMBER BY A DECIMAL

Solve and check these problems. Show your work.

1. 75 ÷ 0.03 =
2. 108 ÷ 0.09 =
3. 84 ÷ 0.007 =
4. 459 ÷ 2.7 =
5. 64 ÷ 0.16 =
6. 125 ÷ 0.25 =
7. 34 ÷ 8.5 =
8. 6 ÷ 0.12 =
9. 406 ÷ 0.029 =
10. 8433 ÷ 0.09 =

BASIC MATH
UNIT III

ASSIGNMENT SHEET #27--WRITING FRACTIONS AS DECIMALS AND PERCENTS

1. Express each fraction as a decimal.

   a. 1/8

   b. 1/4

   c. 1/2

   d. 3/4

   e. 5/8

   f. 7/20

   g. 7/16

   h. 1/9

   i. 4/9

   j. 4/5

2. Express each fraction as a percent.

   a. 1/4

   b. 2/9

   c. 7/10

   d. 3/4

   e. 2/2

   f. 9/11

   g. 1/3

   h. 4/9

   i. 2/6

   j. 5/8

BASIC MATH
UNIT III

ASSIGNMENT SHEET #28--WRITING PERCENTS AS FRACTIONS AND DECIMALS

1. Express each percent as a fraction.
    - a. 50%
    - b. 25%
    - c. 33 1/3%
    - d. 36%
    - e. 28%
    - f. 14 2/7%
    - g. 21%
    - h. 45%
    - i. 66 2/3%
    - j. 70%
2. Express each percent as a decimal.
    - a. 47%
    - b. 15%
    - c. 33.3%
    - d. 62%
    - e. 75%
    - f. 3%
    - g. 16.8%
    - h. 9%
    - i. 10%
    - j. 50%

BASIC MATH
UNIT III

ASSIGNMENT SHEET #29--SOLVING PERCENT PROBLEMS

1. What does it mean to say 100 percent of the class is present today?

2. There are 100 pupils in Podunk High School. Fourteen of them are absent. What percent of the pupils are absent?

3. If 14 of the pupils are absent (Problem 2), how many are present? What percent are present?

4. There are 100 cents in a dollar. Twenty-five cents is what percent of a dollar? Five cents is what percent of a dollar?

5. There are 100 books in a library. Ninety-four have been read. What percent of the books have been read?

6. If 94 of the books (Problem 5) have been read, how many have not been read? What percent have not been read?

ASSIGNMENT SHEET #29

7. If 11% of the pupils in a school are absent, what percent are present?

8. If 6% of the books that a store had in stock were not sold, what percent were sold?

9. If 60% of the cyclists in town had licenses, what percent did not have licenses?

10. Byrl raises white rats. Ten percent of his rats are a year old, and 40% are over a year old. What percent are less than a year old?

11. Susan has three kinds of traps: No. 1 traps, No. 1 1/2 traps, and No. 2 traps. Eighty percent of her traps are No. 1 traps, and 15% are No. 1 1/2 traps. What percent are No. 2 traps?

12. The Smiths spent 22% of their income for their house, 17% for food, 15% for clothes, and 8% for fun. What percent was left for other things?

ASSIGNMENT SHEET #29

13. Chester has finished 75% of the painting he is doing. What percent does he still have to do?

14. Betty has completed 40% of her dress. What percent does she still have to do?

15. If you have completed 93% of these problems, what percent do you still have to do?

BASIC MATH
UNIT III

ASSIGNMENT SHEET #30--FINDING THE PERCENT OF A NUMBER

1. Solve each of the following problems.

   a. 3% of 72 is what number?

   b. 5% of 18 is what number?

   c. What number is 33 1/3% of 96?

   d. 40% of 125 is what number?

   e. 68% of 63.5 is what number?

   f. What number is 12 1/2% of 140.8?

   g. What number is 1% of 103?

   h. What number is 37 1/2% of 152?

   i. 50% of 32.8 is what number?

   j. 7% of 163 is what number?

2. Solve these word problems. Use the back of this sheet to show your work.

   a. There are 20 pupils in a class. Sixty percent of the pupils are boys. How many are boys?

   b. One day 5% of the 20 pupils in Mrs. Moore's class made perfect scores on a spelling test. How many made perfect scores?

   c. Mr. McGill bought a new saw regularly selling for $120 at a sale and saved 20%. How much did he save?

   d. The number of people at the game this week was 75% of what it was last week. Last week there were 800 people at the game. How many people were at the game this week?

   e. Thirty-three and one-third percent of 150 tickets have been sold. How many tickets have been sold?

   f. What is 75% of 20?

   g. On one day only 65% of the 120 pupils in Podunk School were present. How many pupils were present?

BASIC MATH
UNIT III

ASSIGNMENT SHEET #31--COMPUTE BOARD FEET

1. Compute the total board feet in each of the problems listed below.

Formula: $\frac{N \times T \times W \times L}{12}$

N = Number of pieces

T = Thickness in inches

W = Width in inches

L = Length in feet

a. 1 - 1" x 10" x 10' =

b. 1 - 1" x 4" x 14' =

c. 1 - 2" x 6" x 8' =

d. 1 - 2" x 6" x 18' =

e. 2 - 2" x 4" x 8' =

f. 5 - 1" x 8" x 8' =

g. 10 - 4" x 6" x 10' =

h. 1 - 2" x 4" x 18' =

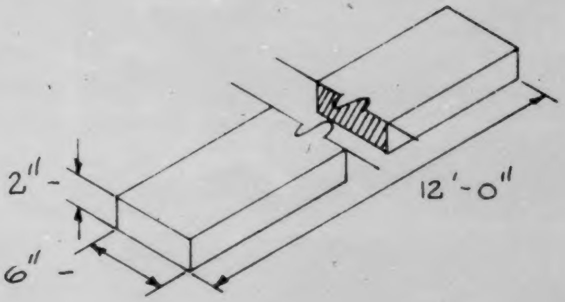
i. 100 - 2" x 12" x 24' =

j. 30 - 1" x 2" x 6' =

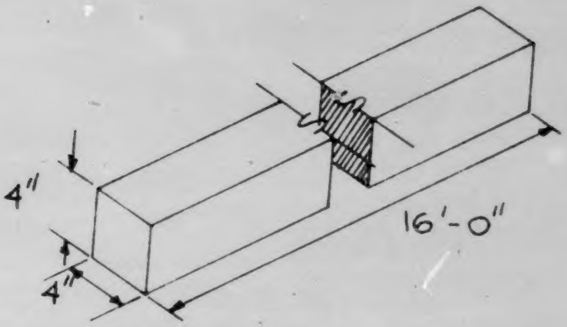
ASSIGNMENT SHEET #31

2. Compute the total board feet for each of the pieces of lumber.

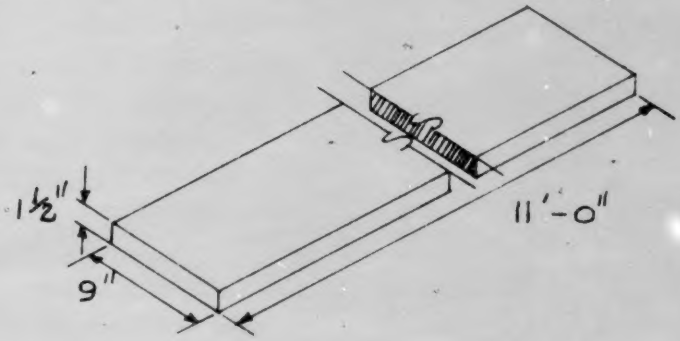
a. ______________________



b. ______________________



c. ______________________



BASIC MATH
UNIT III

ASSIGNMENT SHEET #32--COMPUTE THE COST OF MATERIALS

Compute the cost of each of the lumber orders listed below.

1. 10 - 2" x 4" x 12', utility, fir, price $16.00 per 100 (C) board feet.

   Answer: $ ______________

2. 30 - 1" x 6" x 16', #2, Yellow Pine, price $200.00 per 1000 (M) board feet.

   Answer: $ ______________

3. 40 - 1" x 12" x 14', #2, White Pine, price $0.30 per board foot.

   Answer: $ ______________

4. 100 feet, casing, White Pine, price $16.00 per (C).

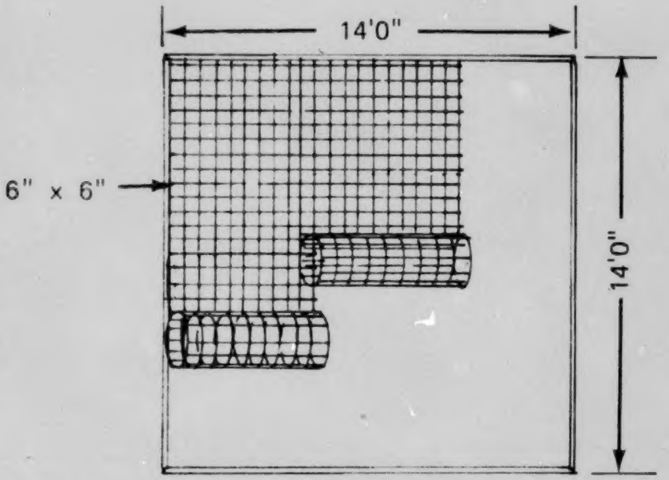
   Answer: $ ______________

BASIC MATH
UNIT III

ASSIGNMENT SHEET #33--CALCULATE THE AMOUNT OF WIRE MESH FOR A JOB

Calculate the amount of wire mesh for the following job. State both the linear feet and square feet.

(NOTE: There must be a six-inch lap for each roll.)



1. Linear feet ________________

2. Square feet ________________

BASIC MATH
UNIT III

ASSIGNMENT SHEET #34--SOLVE BASIC RATIO AND PROPORTION PROBLEMS

Solve the following problems. Show your work.

1. Convert this ratio to whole numbers.

   0.33:0.33:1

2. What would be the proportions if the following mix were cut in half?

   1:2:12

3. What would be the proportion if the following were tripled?

   1:1:3

4. You are asked to mix a batch of mortar using 1 : 1 : 6 ratio, but you will need six times this amount. What proportions of material will be needed?

5. A mixture of 1 part cement, 1 part lime, and 3 parts sand is needed to make 25 cubic feet of mortar. How many cubic feet of each are needed?

BASIC MATH
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. 8, 11, 7, 10, 8, 5 4, 4, 9, 18, 14, 2, 7, 9, 6, 2, 11, 16, 4, 7
2. 8, 3, 0, 10, 4, 1, 9, 10, 5, 9, 8, 4, 9, 2, 6, 3, 9, 8, 6, 11
3. 10, 10, 5, 10, 5, 12, 5, 7, 6, 9, 8, 12, 6, 11, 11, 7, 12, 5, 8, 9
4. 10, 9, 15, 12, 8, 1, 7, 6, 3, 8, 3, 9, 6, 7, 13, 16, 13, 16, 14, 15
5. 12, 15, 12, 15, 14, 17, 14, 11, 12, 13, 14, 13, 13, 7, 11, 10, 13, 11, 17, 10

Assignment Sheet #2

1. 157, 177, 207, 157, 164
2. 151, 191, 148, 174, 135
3. 135, 157, 127, 139, 167
4. 360, 370, 310, 340, 319
5. 334, 439, 469, 410, 434

Assignment Sheet #3

1.
   a. 2606
   b. 2283
   c. 2269
   d. 2820
   e. 1838
   f. 2946
   g. 941
   h. 1471
2.
   a. 1748
   b. 490
   c. 3009

Assignment Sheet #4

1. 5, 1, 3, 3, 2, 6, 1, 0, 4, 1, 1, 0, 8, 0, 2, 1, 0, 7, 2, 0
2. 0, 1, 0, 4, 0, 3, 5, 3, 6, 6, 0, 6, 4, 6, 9, 5, 6, 3, 2, 9
3. 4, 1, 9, 8, 1, 4, 1, 3, 0, 2, 2, 3, 7, 7, 4, 6, 3, 7, 7, 7
4. 3, 2, 8, 4, 1, 5, 7, 3, 5, 4, 8, 2, 6, 9, 4, 5, 9, 7, 9, 8
5. 2, 9, 8, 4, 8, 9, 6, 5, 8, 8, 5, 9, 7, 6, 5, 7, 5, 8, 9, 2

Assignment Sheet #5

1. 19
2. 27
3. 1448
4. 2639
5. 99
6. 327
7. 482
8. 14
9. 48
10. 33
11. 38
12. 56
13. 32
14. 126
15. 178
16. 199
17. 4528
18. 156
19. 1830
20. 5338

Assignment Sheet #6

1. 2
2. 3
3. 45
4. 600
5. 1
6. 4
7. 6
8. 9
9. 312
10. 510
11. 12
12. 17
13. 7
14. 271
15. 12
16. 250
17. 166
18. 3352
19. 402
20. 31

Assignment Sheet #7

1. 2
2. 3
3. 3
4. 4
5. 12
6. 8
7. 12
8. 11
9. 35
10. 9
11. 15
12. 20
13. 25
14. 8
15. 4

Assignment Sheet #8

1. 293 with a remainder of 10
2. 124 with a remainder of 51
3. 186 with a remainder of 4
4. 175
5. 492
6. 258
7. 255
8. 136
9. 327
10. 721 with a remainder of 2
11. 604
12. 1606
13. 302
14. 2010
15. 7013
16. 507
17. 280
18. 3120
19. 344

20. 29
21. 118
22. 226 with a remainder of 11
23. 537 with a remainder of 36

Assignment Sheet #9

1. 12, 0, 18, 0, 8, 0, 20, 0, 0, 24, 16, 24, 4, 9, 0, 36, 6, 12, 5, 0
2. 12, 27, 0, 30, 24, 12, 27, 6, 15, 18, 21, 14, 56, 32, 0, 0, 10, 8, 2, 15
3. 0, 0, 5, 0, 40, 63, 40, 63, 48, 54, 7, 18, 10, 16, 16, 4, 3, 0, 8, 81
4. 49, 0, 6, 20, 9, 1, 18, 64, 3, 6, 7, 2, 0, 25, 4, 0, 14, 9, 0, 8
5. 45, 36, 42, 0, 30, 24, 42, 28, 72, 21, 35, 56, 32, 54, 45, 72, 48, 28, 35, 36

Assignment Sheet #10

1. 212, 96, 104, 328, 228
2. 684, 2265, 624, 3515, 1977
3. 19470, 3609, 9684, 25515, 30492
4. 3367, 22548, 17024, 5448, 31473

Assignment Sheet #11

1. 2394, 2210, 1664, 1932, 4672, 4482
2. 2590, 5130, 2881, 1728, 3034, 6164
3. 3024, 3397, 5704, 5695, 2291, 4005
4. 6794, 5848, 5251, 2736, 4161, 4214

Assignment Sheet #12

1. a. 5, 7
   b. Numerator, denominator
   c. 1, 3
2. a. 10/17
   b. 16/37

3. a. 1
   b. 8
   c. 1/8

Assignment Sheet #13

1. a. 4
   b. 10
   c. 16
   d. 6
   e. 9
   f. 3
   g. 15
   h. 14
   i. 2
   j. 11
   k. 13
   l. 12
   m. 1
   n. 5
   o. 7
2. Evaluated to the satisfaction of the instructor

Assignment Sheet #14

1. a. 5/12
   b. Evaluated to the satisfaction of the instructor
2. a. 3/8
   b. Evaluated to the satisfaction of the instructor
3. a. 10/12 = 5/6
   b. Evaluated to the satisfaction of the instructor
4. a. 1/4
   b. Evaluated to the satisfacton of the instructor
5. a. 4/5
   b. Evaluated to the satisfaction of the instructor

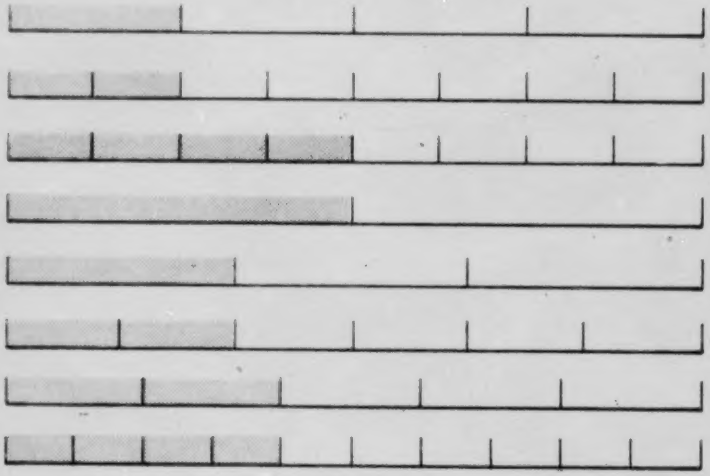
Assignment Sheet #15

1. a. P
   b. P
   c. I
   d. M
   e. P
   f. I
   g. I
   h. M
   i. I
   j. M
   k. M
   l. I
   m. I
   n. P
   o. M

2. a. Answers may vary--Numerators must be smaller than given denominators
   b. Answers may vary--Numerators must be larger than or equal to denominators

Assignment Sheet #16

1. a. 1/4
   2/8
   b. 4/8
   1/2
   c. 1/3
   2/6
   d. 2/5
   4/10



2. a. 2/4
   b. 15/25
   c. 6/1
   d. 1/1
   e. 9/24
   f. 11/12
   g. 10/14
   h. 5/8
   i. 2/3
   j. 110/121

Assignment Sheet #17

1. a. 13/14
   b. 9/2
   c. 22/3
   d. 17/2
   e. 20/3
   f. 26/5
   g. 14/3
   h. 57/7
   i. 46/5
   j. 50/3
   k. 5/2
   l. 14/4
   m. 31/4
   n. 29/3
   o. 17/3
   p. 49/8
   q. 15/4
   r. 34/5
   s. 13/3
   t. 9/5
2. a. 3 1/5
   b. 2 2/5
   c. 5 2/3
   d. 2 2/3
   e. 4 1/2
   f. 1 2/3
   g. 3 1/2
   h. 2 1/4
   i. 1 1/16
   j. 2 1/5
   k. 1 6/13
   l. 1 1/7
   m. 2 11/32
   n. 1 7/17
   o. 1 4/9
   p. 1 3/4
   q. 1 3/6
   r. 1 1/3
   s. 3 3/4
   t. 2 2/7

Assignment Sheet #18

1. 1/3
2. 1/3
3. 2/3
4. 3/5
5. 1/4
6. 3/8
7. 5/7
8. 1/2

9. 3/4
10. 1/2
11. 1
12. 2/3
13. 1/3
14. 1/2
15. 5/6
16. 1/2
17. 2/3
18. 1/3
19. 1
20. 3/4

Assignment Sheet #19

1. a. 7
   b. 10
   c. 4
   d. 1
   e. 9
   f. 2
   g. 3
   h. 6
   i. 8
   j. 5
2. a. 63.9
   b. 5.93
   c. 5.093
   d. 5.0093
   e. 3.825
   f. 38.95
   g. 38.095
   h. 42.3
   i. 402.3
   j. 897.00097
   k. 0.96

Assignment Sheet #20

1. 5.7
2. 5.75
3. 5.756
4. 700.56
5. 500.05
6. 8000.008
7. 99.99
8. 41000.041

9. 10000.0001
10. 14006.66
11. 0.387
12. 0.1025
13. 24.603
14. 14.02
15. 0.00065
16. 23.0006
17. 0.000075
18. 0.00666
19. 0.0097
20. 39.02

Assignment Sheet #21

1. 4
2. 1
3. 3
4. 3
5. 9
6. 6
7. 6
8. 7
9. 8
10. 22
11. 19
12. 20
13. 18
14. 6
15. 13
16. 16
17. 23
18. 9
19. 19
20. 4

Assignment Sheet #22

1. 0.189
2. 1.072
3. 9.22
4. 0.0102
5. 5.99
6. 4.508
7. 71.01
8. 13.132
9. 9.4
10. 287.706
11. 73.2
12. 0.4000 or 0.4
13. 29.26
14. 6.455
15. 19.29
16. 180.99
17. 3299.88
18. 30025.21
19. 0.87139
20. 56.000 or 56

Assignment Sheet #23

1. 351.98
2. 547.144
3. 141.013
4. 508.16
5. $749.25
6. $4.15

7. 670.4
8. 4107.34
9. $2.47
10. 219.215
11. 10.79
12. 0.6547
13. 0.745
14. 0.107
15. 0.00661
16. 19.48
17. 912.55
18. 0
19. 0.0001
20. 7.000 or 7

Assignment Sheet #24

1. 8.184
2. 39.60 or 39.6
3. 1.1475
4. 297.5
5. 100.32
6. 6.4584
7. 0.4565
8. 25.38
9. 0.00069
10. 22.6352
11. 959.79
12. 2.016
13. 709.8
14. 51.975
15. 0.1032
16. 195.16
17. 5.6808
18. 38.958
19. 6.48
20. 492.82

Assignment Sheet #25

1. 9
2. 12.4
3. 33
4. 153
5. 1.5
6. 284
7. 0.8
8. 0.5
9. 300
10. 0.4

Assignment Sheet #26

1. 250
2. 1200
3. 12,000
4. 170
5. 400
6. 500
7. 4
8. 50
9. 14,000
10. 93,700

Assignment Sheet #27

1. a. 0.125
   b. 0.25
   c. 0.5
   d. 0.75
   e. 0.625
   f. 0.35
   g. 0.4375
   h. 0.111 (repeating decimal)
   i. 0.444 (repeating decimal)
   j. 0.80 or 0.8
2. a. 25%
   b. 22 2/9% or 22.22%
   c. 70%
   d. 75%
   e. 100%
   f. 81.81% or 81 9/11%
   g. 33 1/3% or 33.33%
   h. 44.44% or 44 4/9%
   i. 33 1/3% or 33.33%
   j. 62 1/2% or 62.5%

Assignment Sheet #28

1. a. 1/2
   b. 1/4
   c. 1/3
   d. 9/25
   e. 7/25
   f. 1/7
   g. 21/100
   h. 9/20
   i. 2/3
   j. 7/10
2. a. 0.47
   b. 0.15
   c. 0.333
   d. 0.62
   e. 0.75
   f. 0.03
   g. 0.168
   h. 0.09
   i. 0.10 or 0.1
   j. 0.50 or 0.5

Assignment Sheet #29

1. All students are present
2. 14%
3. 86, 86%
4. 25%, 5%
5. 94%
6. 6, 6%
7. 89%
8. 94%
9. 40%
10. 50%
11. 5%
12. 38%
13. 25%
14. 60%
15. 7%

Assignment Sheet #30

1. a. 2.16
    - b. 0.9
    - c. 32
    - d. 50
    - e. 43.18
    - f. 17.6
    - g. 1.03
    - h. 57
    - i. 16.4
    - j. 11.41
2. a. 12 boys
    - b. 1 pupil
    - c. $24
    - d. 600 people
    - e. 50 tickets
    - f. 15
    - g. 78 pupils

Assignment Sheet #31

1. a. 9 board feet
    - b. 5 board feet
    - c. 8 board feet
    - d. 18 board feet
    - e. 11 board feet
    - f. 27 board feet

  - g. 200 board feet
  - h. 12 board feet
  - i. 4,800 board feet
  - j. 30 board feet

2. a. 1 board foot
  - b. 22 board feet
  - c. 13 board feet

Assignment Sheet #32

1. $12.80
2. $48.00
3. $168.00
4. $16.00

Assignment Sheet #33

1. 42 linear feet
2. 210 square feet

Assignment Sheet #34

1. 1:1:3
2. 0.5:1:6
3. 3:3:9
4. 6:6:36
5. 5 cubic feet cement, 5 cubic feet lime, and 15 cubic feet sand

BASIC MATH
UNIT III

TEST

NAME ______________________________ SCORE ____________________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Any one of the ten symbols, 0 to 9, by which all numbers may be expressed

______b. Numbers that are added together

______c. Answer to an addition problem

______d. Number from which another number is being subtracted

______e. Number which is being subtracted from another number

______f. Answer to a subtraction problem

______g. Opposite (inverse) operation of addition

______h. Number by which you divide

______i. Number to be divided

______j. Answer to a division problem

______k. Number left over when division is completed

______l. Act of multiplying; at its simplest, an abbreviated process of adding an integer to itself a specified number of times

______m. Any of the natural numbers; whole numbers

______n. Numbers that are multiplied

______o. Answer to a multiplication problem

______p. Has no factor except itself and one

1. Subtraction
2. Minuend
3. Multiplication
4. Dividend
5. Factors
6. Prime factor
7. Integer
8. Remainder
9. Addends
10. Subtrahend
11. Divisor
12. Product
13. Digit
14. Difference
15. Quotient
16. Sum

_____q. Mathematical proposition

_____r. Branch of mathematics that deals with real numbers and computations with these numbers

_____s. Act of computing or calculating

_____t. To determine by mathematical process

_____u. Tells what part of a whole thing; represents one or more of the equal parts of a unit

_____v. Tells how many equal parts of the whole thing are being considered; top number of the fraction

_____w. Tells into how many equal parts the whole thing is divided; bottom number of the fraction

_____x. Special fractions whose denominators are numbers like 10, 100, 1,000, or 10,000; not written as common fractions but with the denominator shown by the position of a decimal point

_____y. Mark made in writing to indicate place where something is to be inserted

_____z. "Per hundred;" division into 100 parts; another way of expressing a fraction whose denominator is 100

_____aa. Operation that is the opposite of multiplication

17. Division
18. Percent (%)
19. Calculate
20. Numerator
21. Problem
22. Computation
23. Denominator
24. Arithmetic
25. Caret (∧)
26. Fraction
27. Decimals

2. Math the symbols used in math problems to their names.

_____a. Addition

_____b. Subtraction

_____c. Division

_____d. Multiplication

_____e. Equal

_____f. Decimal

_____g. Percent

_____h. Caret

1. $\div$ $\overline{)\quad\quad}$
2. .
3. +
4. %
5. -
6. ∧
7. x
8. =

3. Solve the following math problems involving addition.

   a. 5 + 8 + 5 + 2 + 3 =

   b. 9 + 4 + 3 + 8 =

   c. 35 + 31 + 25 + 17 + 17 + 42 =

   d. 112 + 217 + 333 + 165 + 141 + 332 =

   e. 2, 607 + 3, 389 + 1, 564 + 3, 498 + 2,034 =

4. Solve the following math problems involving subtraction.

   a. $\begin{array}{r}115\\-79\\\hline\end{array}$ b. $\begin{array}{r}2147\\-1448\\\hline\end{array}$ c. $\begin{array}{r}271\\-254\\\hline\end{array}$

   d. $\begin{array}{r}341\\-296\\\hline\end{array}$ e. $\begin{array}{r}734\\-645\\\hline\end{array}$ f. $\begin{array}{r}89,806\\-18,657\\\hline\end{array}$

   g. $\begin{array}{r}9,008\\-996\\\hline\end{array}$ h. $\begin{array}{r}1,003\\-887\\\hline\end{array}$ i. $\begin{array}{r}123,182\\-18,354\\\hline\end{array}$

5. Solve the following math problems involving division.

   a. $6\,\overline{)\,60}$ b. $23\,\overline{)\,161}$ c. $30\,\overline{)\,3604}$

   d. $273\,\overline{)\,6006}$ e. $4\,\overline{)\,5424}$ f. $125\,\overline{)\,172,482}$

6. Solve the following math problems involving multiplication.

   a. 8 x 10 =

   b. 7 x 100 =

   c. 24 x 10 =

   d. 87 x 100 =

   e. 98 x 1000 =

   f. 123 x 1000 =

7. Identify the numerator and denominator in the fraction 4/7.

   a. 4--

   b. 7--

8. Draw the following fractions by dividing and shading the figures to represent the given fractions.

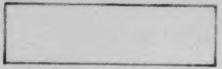
a. 1/3

b. 4/8

c. 2/3

d. 5/6

e. 4/4



9. Solve the following fractional word problem using diagrams to illustrate the solution.

A man has six blocks; four are broken.

a. Draw figures representing the blocks.

b. Shade the broken ones.

c. What part of the blocks were broken? Express as a fraction.

d. What part of the blocks were good? Express as a fraction.

10. Distinguish between proper, improper, and mixed fractions by writing a "P" for proper, "I" for improper, or "M" for mixed.

______a. 1/3

______b. 7 1/5

______c. 9/9

______d. 16 1/3

______e. 8 2/5

______f. 10/25

______g. 2/5

______h. 8 1/2

______i. 1/8

______j. 99/1

11. Write five different fractions which are equivalent to the number one.

a. ______________

b. ______________

c. ______________

d. ______________

e. ______________

12. Write two different equivalent fractions for each of the given fractions.

a. 1/5 =

b. 4/8 =

c. 2/3 =

d. 4/5 =

e. 3/8 =

13. Write each of the following equivalent fractions as indicated.

a. 2/3 = ______/27

b. 4/5 = ______/20

c. 1/8 = ______/24

d. 9/9 = ______/1

e. 16/20 = ______/10

14. Convert the following mixed numbers to improper fractions.

a. 3 1/2 =

b. 4 2/4 =

c. 3 6/9 =

d. 12 4/6 =

e. 13 13/39 =

15. Convert the following improper fractions to mixed numbers or whole numbers.

a. 13/2 =

b. 73/20 =

c. 12/5 =

d. 16/5 =

e. 91/13 =

16. Reduce the following fractions to lowest terms.

a. 4/6 =

b. 4/10 =

c. 2/2 =

d. 8/12 =

e. 3/9 =

f. 7/14 =

g. 6/8 =

h. 8/12 =

i. 8/32 =

j. 12/50 =

k. 2/6 =

l. 4/16 =

m. 6/9 =

n. 2/16 =

o. 2/8 =

p. 8/10 =

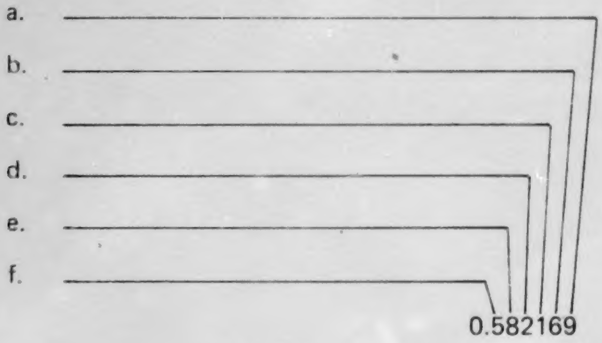
q. 6/6 =

r. 12/16 =

s. 16/32 =

t. 121/132 =

17. Write the place value of each of the digits in this number, 0.582169.



18. Write the following numbers in decimal notation.

a. 23 3/100 =

b. 18 3/10 =

c. 5 5/1000 =

d. 11 24/1,000,000 =

e. 8 13/100,000 =

19. Write the following number words as decimal numerals.

a. Seventy-nine and three tenths =

b. Five and forty-four hundredths =

c. Six thousandths =

d. Ninety-one ten thousandths =

e. Eighty-nine millionths =

20. Write decimals to the nearest whole number, tenth, hundredth, and thousandth.

a. Round to nearest whole number

1) 75.63

2) 8.79

3) 3.1274

b. Round to nearest tenth

1) 25.37

2) 43.333

3) 7.787

c. Round to nearest hundredth

1) 63.634

2) 123.935

3) 3.476

d. Round to nearest thousandth

1) 21.3875

2) 0.6755

3) 0.5807

21. Solve the following problems involving addition of decimals.

(NOTE: Be sure the decimal points and columns are directly under each other.)

a. 3.5 + 5.1 + 7 =

b. 3.4 + 0.206 + 1.74 =

c. 6.86 + 0.0505 + 7.9 + 82 =

d. 57.78 + 0.22 + 0.003 + 74 =

e. 6,319 + 95.12 + 0.0713 + 321.07 =

22. Solve the following problems involving subtraction of decimals.

(NOTE: Be sure to check your answers.)

a. 7.205 - 3.419 =

b. 6.801 - 3.743 =

c. 0.609375 - 0.359375 =

d. 0.765625 - 0.25 =

e. 7.38 - 0.063 =

23. Solve the following problems involving multiplication of decimals.

a. 2.6 x 4.7 =

b. 0.119 x 0.05 =

c.
```
  0.8
x   9
-----
```

d.
```
   92.07
 x 7.392
--------
```

e. 9.5 x 0.76 =

24. Solve the following problems dividing a decimal by a decimal.

(NOTE: Be sure to check your answers.)

a. $0.4\overline{)5.32}$ b. 83.4 ÷ 0.6 = c. 0.765 ÷ 0.5 =

25. Solve the following problems dividing a whole number by a decimal.

a. 24 ÷ 0.2 = b. 54 ÷ 0.09 = d. 63 ÷ 0.007 =

26. Write the following fractions as decimals and percents.

a. 1/3 =

b. 3/25 =

c. 7/16 =

d. 2/7 =

e. 5/6 =

27. Write the following percents as fractions and decimals.

a. 12% =

b. 29% =

c. 45% =

d. 72% =

e. 250% =

28. Solve the following percent problems.

a. A motor with 150 horsepower runs with an 87% efficiency. How much horsepower is actually delivered?

b. If cement shrinks 12% while in storage, how many barrels will be left from 2100 barrels placed in storage?

c. If a contractor bought a truck for $2400 and sold it for $3000 what is the percent of profit?

29. Compute the cost of the sale item in the problem below.

A $45.00 saw is on sale at a discount of 10%. What is the sale price?

30. Write the decimal and fraction equivalents using the chart which your instructor will provide.

    a. Decimals

        1) 9/32 =

        2) 63/64 =

        3) 1/4 =

        4) 17/32 =

        5) 1/8 =

    b. Fractions

        1) 0.4375 =

        2) 0.96875 =

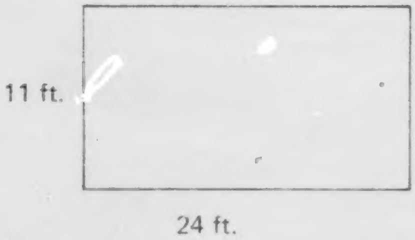
        3) 0.75 =

        4) 0.125 =

        5) 0.296875 =

31. Calculate the following basic math problem dealing with area using the formula given.

    Length x Width = Area



32. Write the formula for figuring board feet.

33. Compute the number of board feet and cost in the following bill of materials.

    40 - 2" x 6" x 16', utility, Yellow Pine, KD, S4S at $270.00 per M.

    a. Board feet =

    b. Cost =

34. Write the formula for estimating concrete.

35. Write the procedure for estimating wire mesh.

36. State the difference between ratio and proportion as related to concrete.

a. Ratio--

b. Proportion--

BASIC MATH
UNIT III

ANSWERS TO TEST

1. a. 13
   b. 9
   c. 16
   d. 2
   e. 10
   f. 14
   g. 1
   h. 11
   i. 4
   j. 15
   k. 8
   l. 3
   m. 7
   n. 5
   o. 12
   p. 6
   q. 21
   r. 24
   s. 22
   t. 19
   u. 26
   v. 20
   w. 23
   x. 27
   y. 25
   z. 18
   aa. 17

2. a. 3
   b. 5
   c. 1
   d. 7
   e. 8
   f. 2
   g. 4
   h. 6

3. a. 23
   b. 24
   c. 167
   d. 1300
   e. 13,092

4. a. 36

   b. 699

   c. 17

   d. 45

   e. 89

   f. 71,149

   g. 8,012

   h. 116

   i. 104,828

5. a. 10

   b. 7

   c. 120 with a remainder of 4

   d. 22

   e. 1,356

   f. 1,379 with a remainder of 107

6. a. 80

   b. 700

   c. 240

   d. 8,700

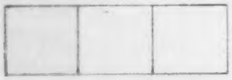
   e. 98,000

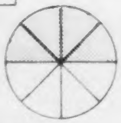
   f. 123,000

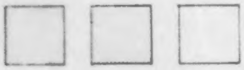
7. a. Numerator

   b. Denominator

8. Answers should be similar to those given below.

   a. 

   b. 

   c. 

d.

e.

9. a.

b.

c. 4/6 = 2/3

d. 2/6 = 1/3

10. a. P

b. M

c. I

d. M

e. M

f. P

g. P

h. M

i. P

j. I

11. Answers will vary.

12. Answers will vary.

13. a. 18/27

b. 16/20

c. 3/24

d. 1/1

e. 8/10

14. a. 7/2

b. 18/4

c. 33/9

d. 76/6

e. 520/39

15. a. 6 1/2

b. 3 13/20

c. 2 2/5

d. 3 1/5

e. 7

16. a 2/3
b. 2/5
c. 1
d. 2/3
e. 1/3
f. 1/2
g. 3/4
h. 2/3
i. 1/4
j. 6/25
k. 1/3
l. 1/4
m. 2/3
n. 1/8
o. 1/4
p. 4/5
q. 1
r. 3/4
s. 1/2
t. 11/12

17. a. Millionths
b. Hundred-thousandths
c. Ten-thousandths
d. Thousandths
e. Hundredths
f. Tenths

18. a. 23.03
b. 18.3
c. 5.005
d. 11.000024
e. 8.00013

19. a. 79.3
b. 5.44
c. 0.006
d. 0.0091
e. 0.000089

20. a. 1) 76

2) 9

3) 3

b. 1) 25.4

2) 43.3

3) 7.8

c. 1) 63.63

2) 123.94

3) 3.48

d. 1) 21.388

2) 0.676

3) 0.581

21. a.

$$\begin{array}{r} 3.5 \\ 5.1 \\ \underline{7.0} \\ 15.6 \end{array}$$

b.

$$\begin{array}{r} 3.400 \\ 0.206 \\ \underline{1.740} \\ 5.346 \end{array}$$

c.

$$\begin{array}{r} 6.8600 \\ 0.0505 \\ 7.9000 \\ \underline{82.0000} \\ 96.8105 \end{array}$$

d.

$$\begin{array}{r} 57.780 \\ 00.220 \\ 00.003 \\ \underline{74.000} \\ 132.003 \end{array}$$

e.

$$\begin{array}{r} 6319.0000 \\ 0095.1200 \\ 0000.0713 \\ \underline{0321.0700} \\ 6735.2613 \end{array}$$

22. a. 3.786

b. 3.058

c. 0.250000 = 0.25

d. 0.515625

e. 7.317

23. a. 12.22

b. 0.00595

c. 7.2

d. 680.58144

e. 7.22

24. a. 13.3

b. 139

c. 1.53

25. a. 120

b. 600

c. 9,000

26. a. 0.33 (repeating decimal); 33 1/3% or 33.33%

b. 0.12; 12%

c. 0.4375; 43.75% or 43 3/4%

d. 0.2857; 28.57% or 28 4/7%

e. 0.833 (repeating decimal); 83 1/3% or 83.33%

27. a. 3/25; 0.12

b. 29/100; 0.29

c. 9/20; 0.45

d. 18/25; 0.72

e. 5/2; 2.50

28. a. 130.50 horsepower

b. 1848 barrels

c. 20%

29. $40.50

30. a. 1) 0.28125

2) 0.984375

3) 0.25

4) 0.53125

5) 0.125

b. 1) 7/16

2) 31/32

3) 3/4

4) 1/8

5) 19/64

31. 264 square feet

32.
$$\frac{\text{Number of Pieces} \times \text{Thickness in Inches} \times \text{Width in Inches} \times \text{Length in Feet}}{12}$$

33. a. 640 board feet

    b. $172.80

34. $$\frac{\text{Width in Feet x Length in Feet X Thickness in Feet}}{27} = \text{Cubic yards of concrete}$$

35. a. Mesh roll size

        1) 5' x 150'

        2) 750 square feet

    b. Calculate linear feet

36. a. Ratio--Indicates parts of material per mix

    b. Proportion--Indicates the ratio is the same but the quantity may be different

729

COMMERCIAL CARPENTRY

PROGRESS CHART

Section E-1
Blueprint Reading

Job	UNIT I BLUEPRINT READING										UNIT II ADVANCED BLUEPRINT READING									
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Student's Name	UNIT TEST	Read Architect's Scale Using Full Scale or (12" = 1')	Read Architect's Scale Using Half Scale or (6" = 1')	Read Architect's Scale Using One-Fourth Scale or (3" = 1')	Read Architect's Scale Using One-Eighth Scale or (1 1/2" = 1')	Read Engineer's Scale Using Scale of 1" = 1'	Read Engineer's Scale Using Scale of 1" = 30'	Read Engineer's Scale Using Scale of 1" = 50'			UNIT TEST	Identify Architectural Elevations	Identify Architectural Schedules	Identify Lines and Symbols	Identify Mechanical Symbols	Identify Electrical Symbols	Identify Topographic Symbols			
1																				
2																				
3																				
4																				
5																				
6																				
7																				

9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
Accuracy	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct			85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct			

COMMERCIAL CARPENTRY
PROGRESS CHART

UNIT III
BASIC MATH

Section E-2
Blueprint Reading

Job Student's Name	1 UNIT TEST	2 100 Addition Combinations	3 Two-Digit Numbers	4 Three-Digit Numbers	5 100 Subtraction Combinations	6 Two-, Three-, and Four-Digit Numbers	7 One-Digit Divisor	8 Two-Digit Divisor	9 Two- and Three-Digit Divisors	10 Multiplication Facts	11 Multiplying by a One-Digit Factor	12 Multiplying by a Two-Digit Factor	13 Parts of a Fraction	14 Fractional Parts	15 Fractional Word Problems	16 Types of Fractions	17 Equivalent Fractions	18 Fraction Conversion	19 Reducing Fractions	20 Decimal Notation
1																				
2																				
3																				
4																				
5																				
6																				

8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
Accuracy	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct

COMMERCIAL CARPENTRY
PROGRESS CHART

Section E-3
Blueprint Reading

Student's Name	UNIT III BASIC MATH (Continued)																			
Job	21 Number Words	22 Rounding to Nearest Whole Number	23 Adding Decimals	24 Subtracting Decimals	25 Multiplying Decimals	26 Dividing a Decimal by a Decimal	27 Dividing a Whole Number by a Decimal	28 Writing Fractions as Decimals and Percents	29 Writing Percents as Fractions and Decimals	30 Solving Percent Problems	31 Finding the Percent of a Number	32 Compute Board Feet	33 Compute Cost of Materials	34 Calculate Amount of Wire Mesh for a Job	35 Solve Basic Ratio and Proportion Problems	36	37	38	39	40
1																				
2																				
3																				
4																				
5																				
6																				
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19																				
20																				
Accuracy	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct	85% Correct					

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Section F
site

BUILDER'S LEVEL AND TRANSIT
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the different types of levels, parts of the builder's level, and parts of transits. The student should also demonstrate the ability to set up and adjust the instruments, perform leveling jobs, and establish lines. This knowledge will be evidenced by completion of the assignment sheet, job sheets, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with the builder's level and transit to the correct definitions.
2. Identify the different types of levels.
3. Discuss the types of self-reading rods.
4. Identify the parts of the builder's level.
5. Distinguish between the vertical cross hair and the horizontal cross hair on the builder's level.
6. Identify the parts of the leveling rod.
7. Match the parts of the rod to their correct uses.
8. Identify the fundamental parts of a transit.
9. Identify specific parts of the transit.
10. List rules to follow in providing care of the instruments.
11. Identify hand motions used by the instrument person to guide the target person.
12. Read the self-reading rod (positive reading).
13. Demonstrate the ability to:
    a. Set up and adjust the builder's level.
    b. Set up and adjust the transit over a point and establish lines with two points given.
    c. Perform a differential leveling job.

BUILDER'S LEVEL AND TRANSIT
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss the procedures outlined in the job sheets.

   G. Provide different leveling jobs for students.

   H. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Types of Levels

      2. TM 2--Types of Levels (Continued)

      3. TM 3--Self-reading Rods

      4. TM 4--Parts of the Builder's Level

      5. TM 5--Parts of the Leveling Rod

      6. TM 6--The Transit

      7. TM 7--Fundamental Parts of the Transit

      8. TM 8--Specific Parts of the Transit

      9. TM 9--Hand Motions

      10. TM 10--Reading the Rod: Positive Reading Rod

   D. Assignment Sheet #1--Read the Self-reading Rod (Postive Reading)

   E. Answers to assignment sheet

F. Job sheets

1. Job Sheet #1--Set Up and Adjust the Builder's Level
2. Job Sheet #2--Set Up and Adjust the Transit over a Point and Establish Lines with Two Points Given
3. Job Sheet #3--Perform a Differential Leveling Job

G. Test

H. Answers to test

III. Unit references:

A. Schwab, Glenn O. et al. *Elementary Soil and Water Engineering.* New York: John Wiley and Sons, Inc., 1957.

B. Phillips, Lloyd J.; McColly, H. F.; Scranton, L. L.; and Cook, G. C. *Farm Mechanics Text and Handbook.* Danville, Illinois: The Interstate Printers and Publishers, Inc., 1967.

C. Kissam, Philip C. E. *Surveying Practices.* 2nd ed. New York: McGraw-Hill Book Company, 1971.

D. Hendrix, Laborn J. "Bud," and Patton, Bob. *Cement Mason's Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1975.

E. *Setting Up the Instrument.* San Luis Obispo: California State Polytechnic College.

(NOTE: This is a color filmstrip and manual.)

F. *Reading the Rod.* San Luis Obispo: California State Polytechnic College.

(NOTE: This is a color filmstrip and manual.)

BUILDER'S LEVEL AND TRANSIT
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Builder's level--Instrument consisting of a telescope, leveling bubble, and tripod used primarily for establishing grade levels

B. Bench mark (BM)--Permanent point of known or assumed elevation

(NOTE: Specific point on curb or culvert is sometimes used.)

C. Temporary bench mark (TBM)--Serves as elevation reference point

D. Fall--Pertaining to the slope of a line, such as inches of fall per foot of run

Example: 1" fall per 1' of run

E. Grade line--Proposed or future level of ground at construction line

F. Height of instrument (HI)--Vertical distance from the bench mark to the line of sight of the instrument

G. Grade stake--Stake driven into the ground locating the proposed grade

(NOTE: Read from the bench mark.)

H. Site--Plot of ground on which a project is to be constructed

I. Line of sight--Level line through the instrument as viewed by the eye; place where vertical hair crosses the horizontal hair

J. Self-reading rod--Scale on rod adjusted to height of instrument elevation and direct surface elevation and read by instrument person

K. Differential leveling--Method of leveling by which the difference in elevation between two points is determined by "+" (plus) and "-" (minus) rod readings which are totaled and adjusted to the bench mark

L. Leveling rod--Rod used in leveling with the builder's level and usually graduated in tenths and hundredths of a foot

M. Transit--Instrument used for surveying; designed and used for measuring both horizontal and vertical angles

N. Surveying--Art or science of determining the area and configuration of portions of the surface of the earth

INFORMATION SHEET

O. Plumb bob–Tool or device attached to a string; used to set and/or check the plumb or perpendicular of a surface

P. Elevation–Given grade

Q. Laser beam instrument–Automatic leveling instrument which uses a laser beam to establish elevation readings

II. Types of levels (Transparencies 1 and 2)

A. Engineer's dumpy

B. Engineer's wild tilting

C. Turret

D. Engineer's zeiss

E. Builder's

(NOTE: The builder's level is the most practical and economical for general use and is sufficiently accurate for most purposes.)

F. Laser beam instrument

III. Types of self-reading rods (Transparency 3)

A. Positive reading–Gives difference in elevation between HI and elevation of the ground where shot is being taken

B. Direct reading–Adjust the rod to true elevation and any reading taken through the instrument at this point would automatically be the true elevation

IV. Parts of the builder's level (Transparency 4)

A. Eyepiece

B. Telescope barrel

C. Focusing screw

D. Sun shade

E. Bubble tube

F. Leveling head

G. Leveling screw

H. Head plate

INFORMATION SHEET

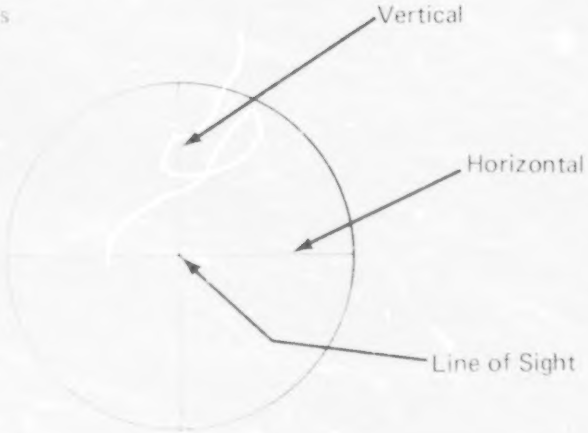
I. Tripod

J. Leg thumb nut

K. Slow motion screw

L. Clamp

V. Cross hairs



A. Vertical

(NOTE: This indicates direction.)

B. Horizontal

(NOTE: This indicates flat plane.)

C. Line of sight

(NOTE: This is indicated by the cross of the vertical and horizontal hairs.)

VI. Parts of leveling rod (Transparency 5)

A. Target face

B. Target clamp

C. Rod clamp

D. Vernier scale

INFORMATION SHEET

VII. Parts of the leveling rod and their uses (Transparency 5)

A. Target face–Red and white disc on rod used for certain types of readings

B. Target clamp–Holds the target in place

C. Rod clamp–Holds the rod when extended

D. Vernier scale–Found on target face and rod clamp; enables reading to the nearest thousandth of a foot

VIII. Fundamental parts of a transit (Transparencies 6 and 7)

A. Alidade

B. Circle

C. Leveling head

IX. Specific parts of the transit (Transparency 8)

A. A vernier

B. Azimuth axis

C. X vernier

D. Center of half ball

E. Elevation or horizontal axis

F. Footplate

G. Graduations of horizontal circle

H. Half ball

I. Half ring

J. Horizontal circle (lower plate)

K. Inner center or alidade spindle

L. Leveling screw

M. Lower clamp drum contact

INFORMATION SHEET

N. Nub for lower clamp

O. Outer center

P. Plate level

Q. Shifting plate

R. Shoe

S. Telescope

T. Threads for tripod

U. Upper clamp drum contact

V. Upper plate

W. Upper tangent screw for slow motion

X. Vertical circle

Y. Vertical circle vernier

Z. Window, glass

AA. Telescope level

BB. Vertical tangent screw for focusing on object sighted

CC. Focusing screw for focusing on object sighted

DD. Eyepiece focusing ring

X. Care of the instruments

A. Protect against shock and vibration during transport

B. Keep in case except when in use

C. Place lens and tripod cap in box after removing from instrument

D. Attach instrument onto tripod carefully and firmly before moving tripod

(NOTE: Never force screws or other moving parts of an instrument.)

INFORMATION SHEET

- E. Always use sun shade regardless of the weather
- F. Clean lenses with soft tissue

  (CAUTION: Do not clean with fingers or rough cloth. Do not remove lenses.)

- G. Loosen set screws when not in use

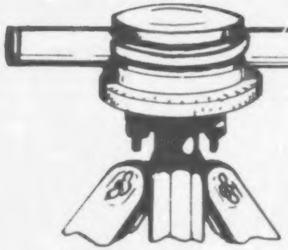
XI. Hand motions (Transparency 9)

- A. Move in this direction
- B. Move up
- C. Move down
- D. Turning point
- E. Observation completed; move on; understood
- F. Come in
- G. Wrong face; check clamp; rod upside down
- H. Use long rod
- I. Wave rod from side to side

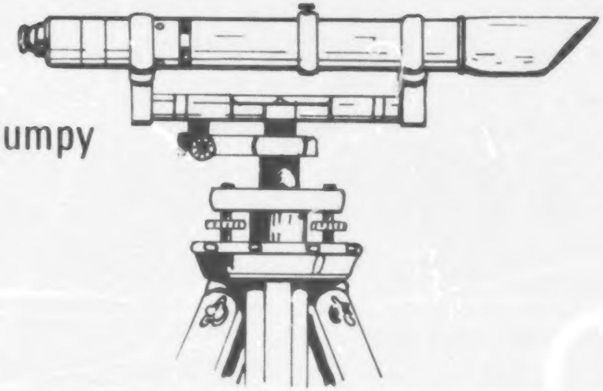
XII. Reading the rod (Transparency 10, Assignment Sheet #1)

- A. Large red numbers are full foot numbers
- B. Smaller black numbers are 0.1 feet (tenths of feet)
- C. Top and bottom of small black marks are 0.01 feet (hundredths of feet)
- D. Vernier scale reads 0.001 feet (thousandths of feet)

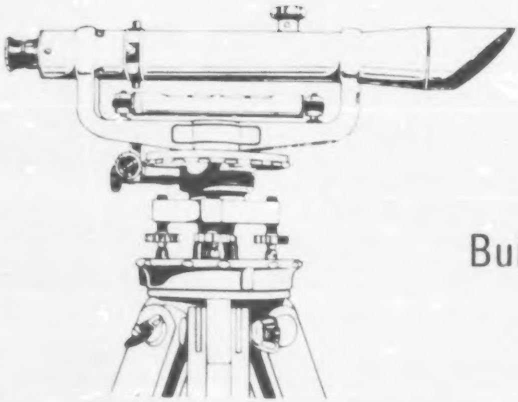
Types of Levels



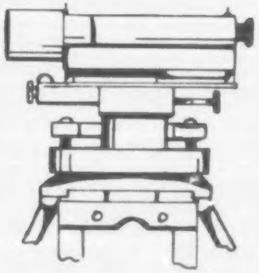
Turret



Engineer's Dumpy



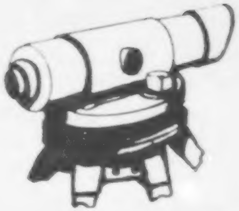
Builder's



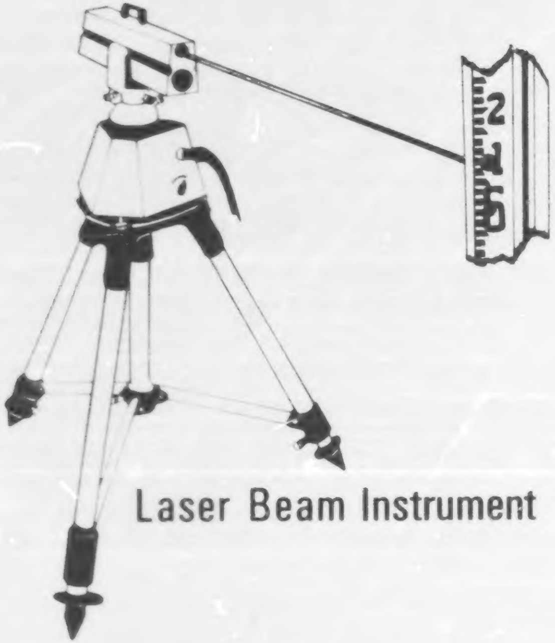
Engineer's Wild Tilting

Types of Levels

(Continued)



Engineer's Zeiss



Laser Beam Instrument

Self-Reading Rods

Positive

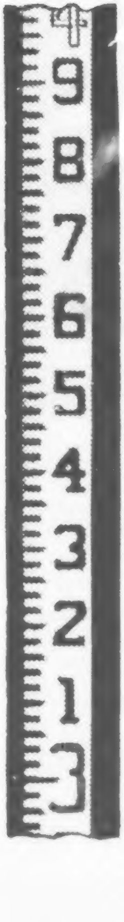
↑

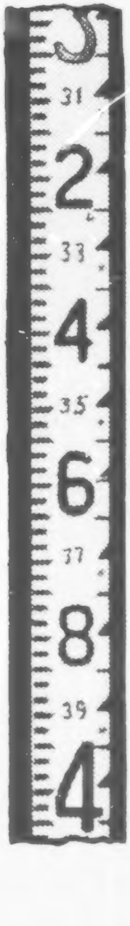
Reading

Philadelphia

or

"Philly" Rod


4
9
8
7
6
5
4
3
2
1
3


3
31
2
33
4
35
6
37
8
39
4

Direct

↓

Reading

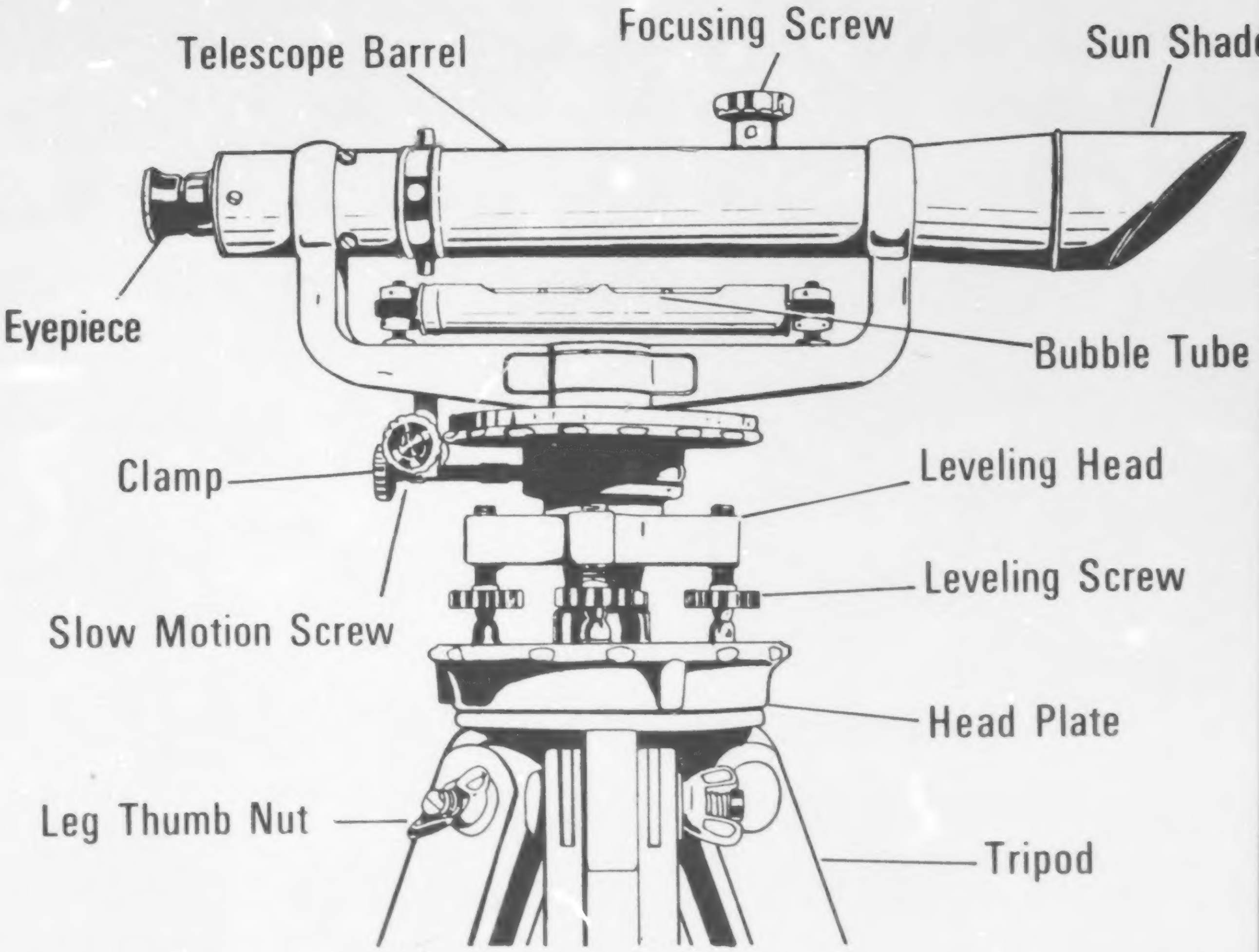
Elevation

or

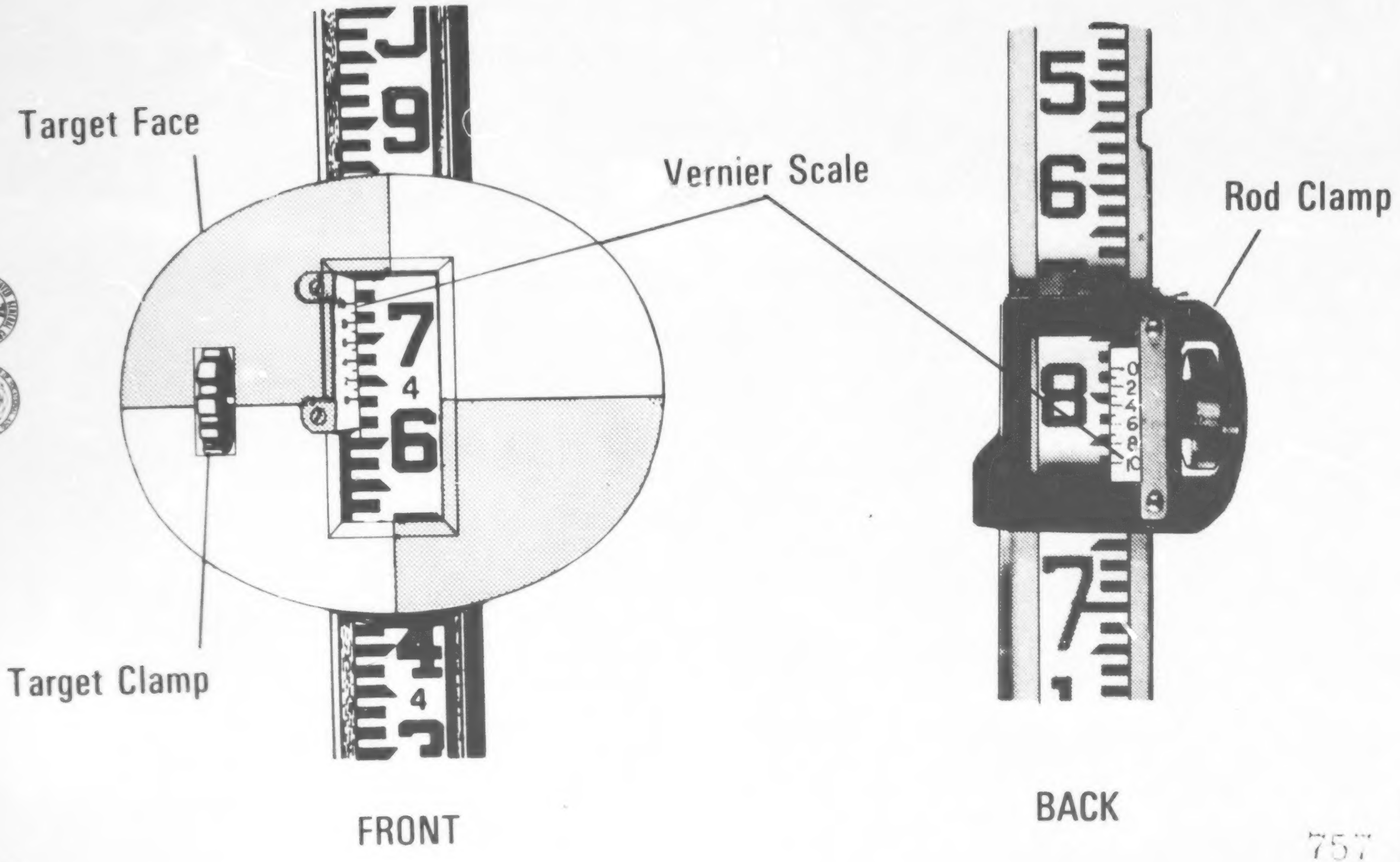
"Linker" Rod

TM 3

Parts of the Builder's Level

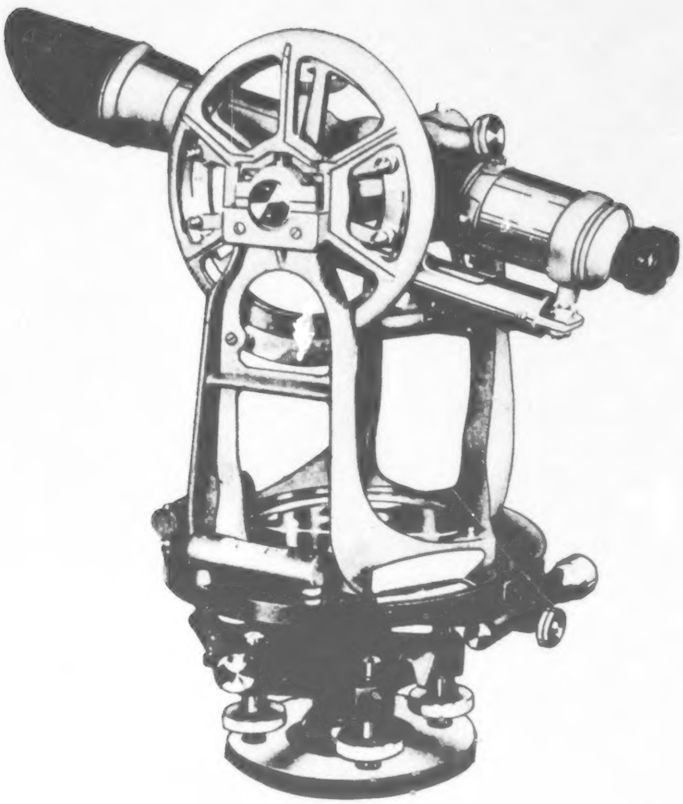

Telescope Barrel
Focusing Screw
Sun Shade
Eyepiece
Bubble Tube
Clamp
Leveling Head
Slow Motion Screw
Leveling Screw
Head Plate
Leg Thumb Nut
Tripod

Parts of the Leveling Rod


Target Face
Vernier Scale
Rod Clamp
Target Clamp
FRONT
BACK

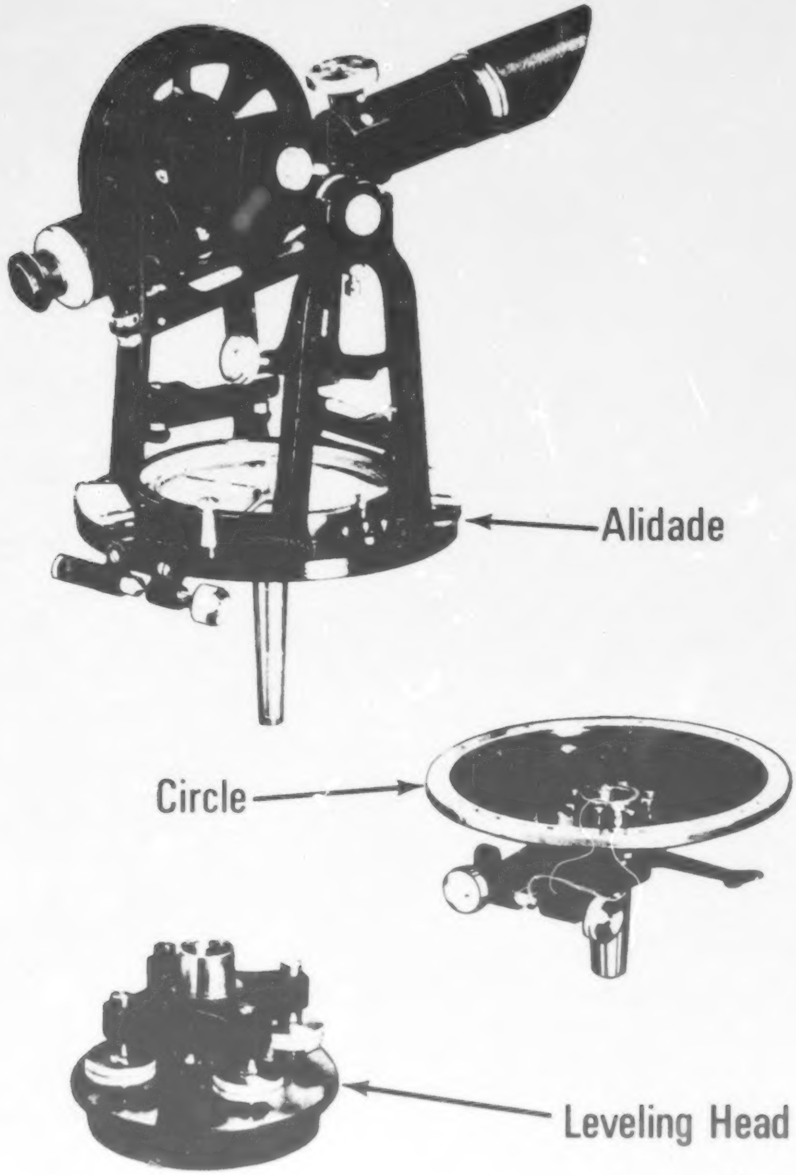
CC - 21-F

The Transit



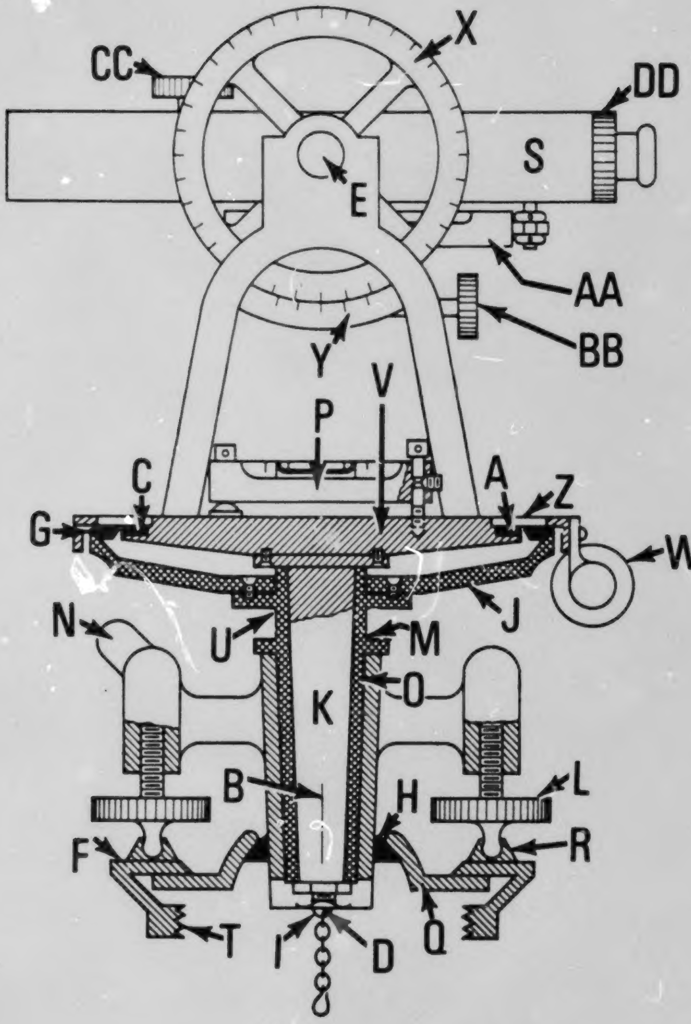
TM 6

Fundamental Parts of the Transit


Alidade
Circle
Leveling Head

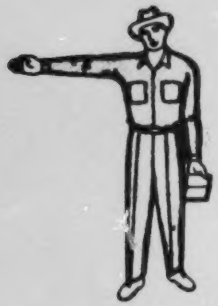
759

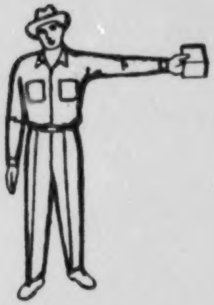
Specific Parts of the Transit

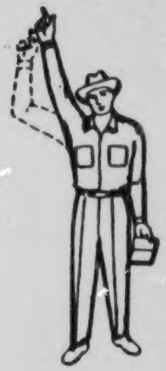

X
CC
DD
S
E
AA
BB
Y
V
P
C
A
Z
G
W
J
N
U
M
O
K
L
B
H
F
R
T
I
D
Q

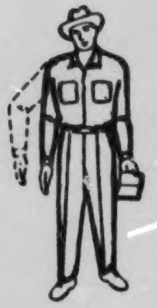
THE ABOVE LETTERS CORRESPOND TO THE PARTS LISTED ON PAGES 8 AND 9

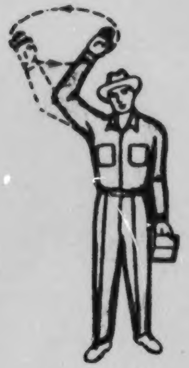
Hand Motions

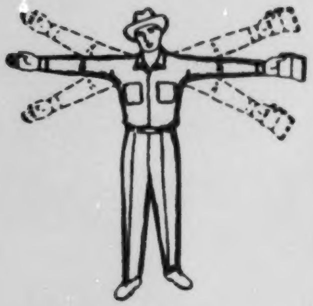

Move in this Direction

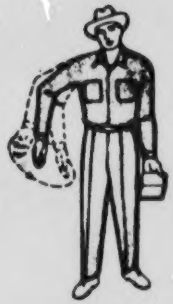

Move in this Direction

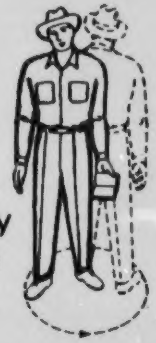

Move Up


Move Down

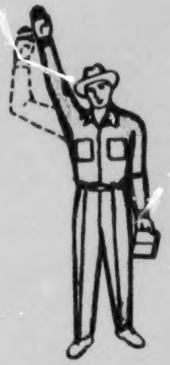

Turning Point

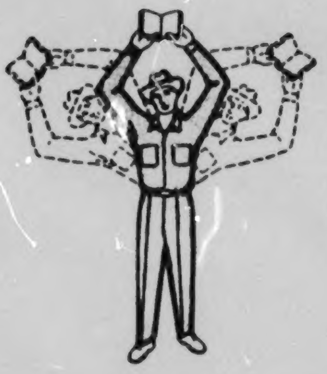

Observation Completed
or Move On
or Understood


Come In


Step
Away
from
Inst.
Walk
in
Tight
Circle

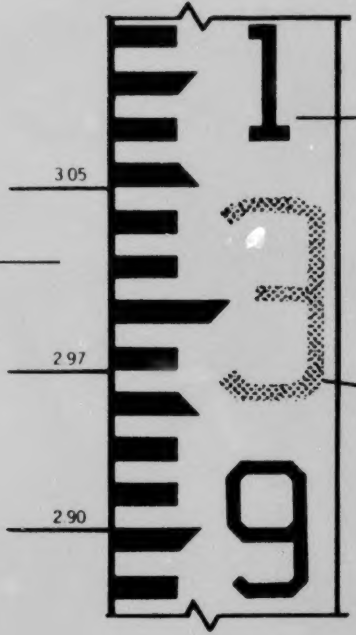
Wrong Face
or Check Clamp
or Rod Upside Down


Use
Long Rod


Wave Rod from
Side to Side

Reading the Rod

(Positive Reading Rod)



Hundredths of Feet

(Black and White)

Tenths of Feet

(Black)

Full Foot Numbers

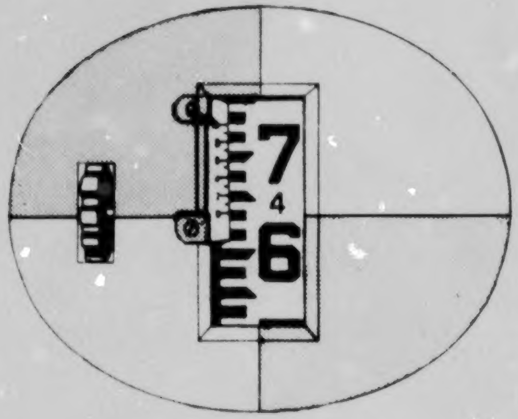
(Red)

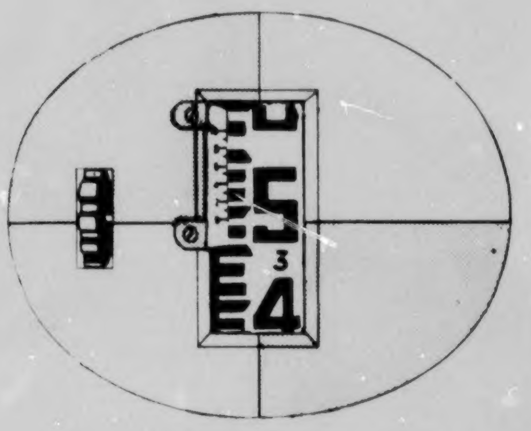
NOTE: Vernier scale reads thousandths of feet

BUILDER'S LEVEL AND TRANSIT
UNIT I

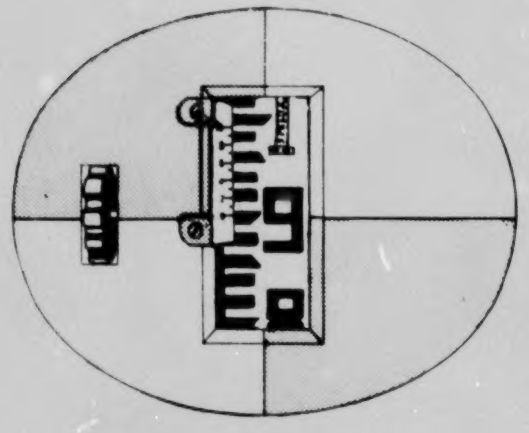
ASSIGNMENT SHEET #1--READ THE SELF-READING ROD (POSITIVE READING)

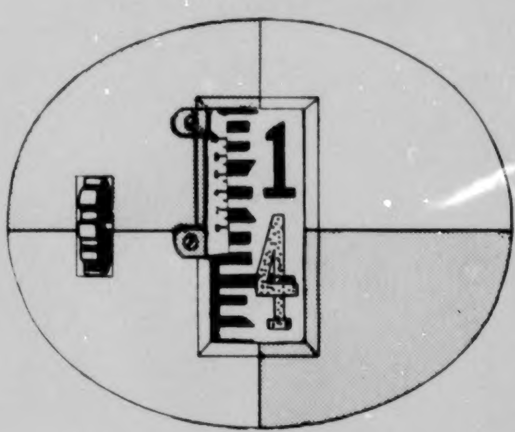
Read each of the illustrations below to the nearest hundredth. Record your results in the blanks provided.





a. ______________________________ b. ______________________________





c. ______________________________ d. ______________________________

BUILDER'S LEVEL AND TRANSIT
UNIT I

ANSWERS TO ASSIGNMENT SHEET

a. 4.64

b. 3.49

c. 0.90

d. 4.04

BUILDER'S LEVEL AND TRANSIT
UNIT I

JOB SHEET #1--SET UP AND ADJUST THE BUILDER'S LEVEL

I. Tools and equipment

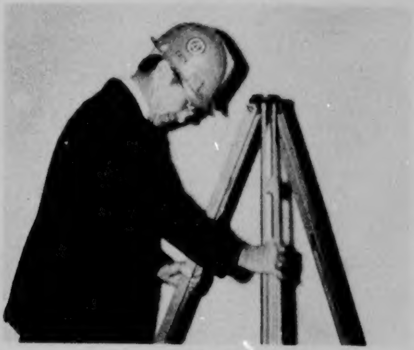
A. Instrument

B. Tripod

II. Procedure

A. Grasp the two legs of the tripod that are nearest you and set the leg shoes in the ground about three feet apart (Figure 1)

FIGURE 1



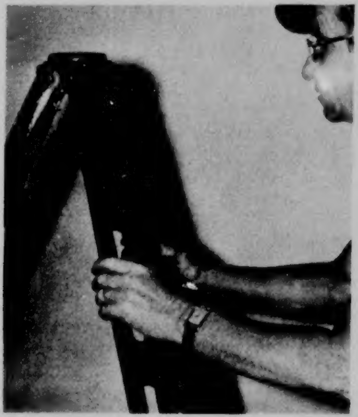
B. Swing third leg out to form a triangle

(NOTE: If the ground is not level, you may have to change position of tripod in order to keep head plate level. Always place two legs on downhill or unlevel side.)

C. Tighten leg thumb nuts

D. Check head plate to see if it is level (Figure 2)

FIGURE 2

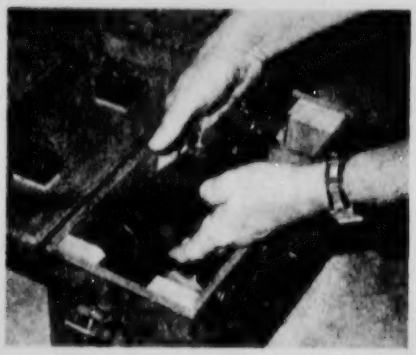


JOB SHEET #1

E. Remove instrument from carrying case by lifting the level bar (Figure 3)

(CAUTION: Never grasp the telescope barrel while removing instrument from carrying case.)

FIGURE 3



F. Attach instrument to head plate by screwing it down (Figure 4)

(CAUTION: Keep a firm grip on instrument until it is securely in position on tripod.)

FIGURE 4

G. Remove dust cap from front lens

(NOTE: The dust cap should be kept in place in order to protect the lens from dust or scratches.)

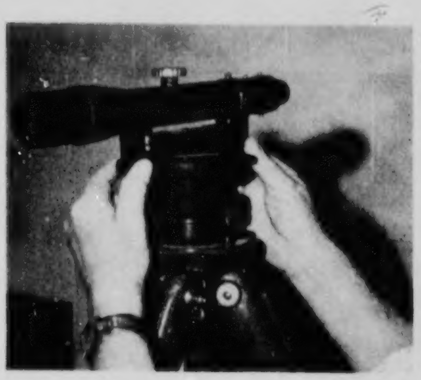
H. Attach sun shade to the instrument

JOB SHEET #1

I. Align telescope barrel directly over one pair of leveling screws (Figure 5)

(NOTE: The leveling screws will be used just as the name indicates, to level the instrument.)

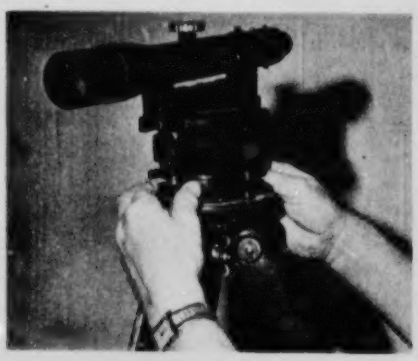
FIGURE 5



J. Rotate screws under the leveling head to bring bubble to the center of the leveling tube (Figure 6)

(NOTE: Move your thumbs in opposite directions.)

FIGURE 6

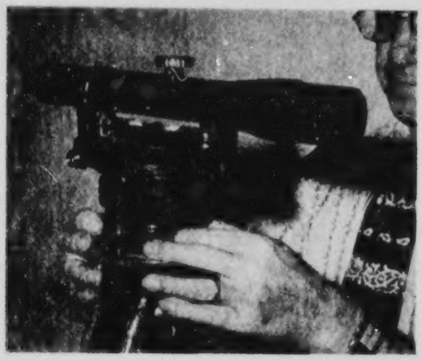


JOB SHEET #1

K. Check bubble to see if it is centered

L. Turn instrument clockwise through 90 degrees to align with the other pair of leveling screws (Figure 7)

FIGURE 7



M. Bring bubble to center of marks by rotating leveling screws

N. Turn instrument clockwise through 90 degrees to bring it parallel with first pair of leveling screws

O. Center bubble again

P. Turn instrument clockwise through 90 degrees to bring it parallel with second pair of leveling screws

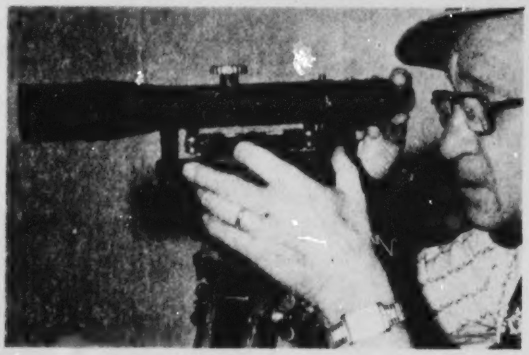
Q. Center bubble again

(NOTE: Bubble should stay in center regardless of what direction the telescope is pointing. If bubble does not, instrument is out of level and should be adjusted by competent personnel.)

R. Focus cross hairs so that they appear sharp and clear (Figure 8)

(NOTE: Focusing is accomplished by looking through the eyepiece and by turning the eyepiece ring until the cross hairs become sharp and clear.)

FIGURE 8



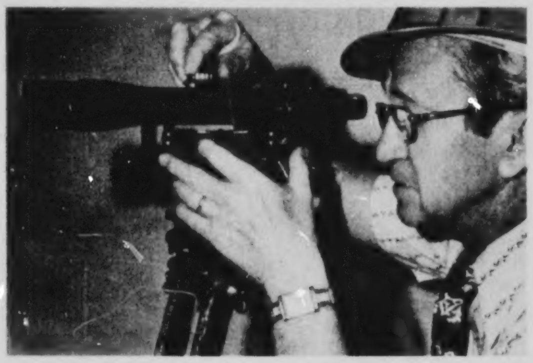
JOB SHEET #1

S. Be sure cross hairs are focused

(NOTE: The target may not be in focus.)

T. Rotate the focusing screw to bring target into sharp focus (Figure 9)

FIGURE 9



(NOTE: When cross hairs and target are in sharp focus, you should be able to read a rod accurately. Always tie level shots back to starting bench mark to check for error in rod shots or in field notes.)

(CAUTION: After instrument is level, keep hands off tripod. Use the instrument only. If instrument creeps off level or is bumped, stop, reset tripod, relevel instrument, and start again from last known good bench mark.)

BUILDER'S LEVEL AND TRANSIT
UNIT I

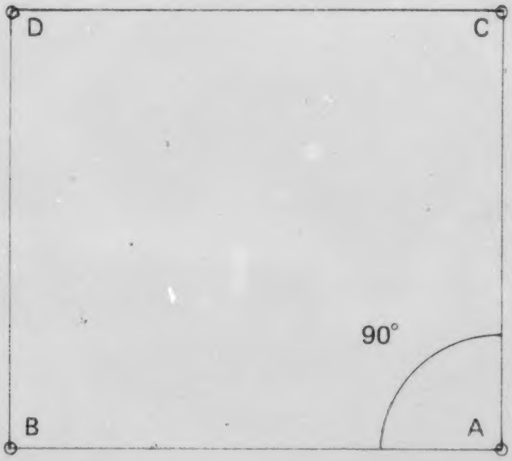
JOB SHEET #2--SET UP AND ADJUST THE TRANSIT OVER A POINT AND ESTABLISH LINES WITH TWO POINTS GIVEN

I. Tools and equipment

- A. Instrument
- B. Plumb bob
- C. Tripod
- D. Tape
- E. Claw hammer
- F. Surveyor tacks
- G. Sledge hammer
- H. Stakes

II. Procedure (Figure 1)

FIGURE 1



- A. Stand about two feet from and facing over point A where the transit is to be set up, grasp two legs, and place the third leg on the ground about two feet from the point
- B. Swing the other two legs outward and backward, placing them on the ground so that the footplate is nearly level
- C. Remove instrument from the case and, holding it by the base, screw it firmly on the tripod

JOB SHEET #2

D. Remove dust cap and replace with the sun shade

(NOTE: The sun shade should always be used.)

E. Attach the plumb bob and center the instrument on the footplate

F. Move the transit bodily without changing the relative position of the legs, so that the plumb bob hangs within two or three inches of the point

G. Firmly set the tripod legs into the ground

H. Raise or lower the plumb bob until it hangs about one inch above the point

I. Move the leg that is on the opposite side of the point from the plumb bob and set it so that it is exactly opposite a second leg

J. Move second leg until the plumb bob comes within one-quarter inch of point

K. Loosen two adjacent leveling screws

L. Slide the head until the plumb bob is over the point

(NOTE: Slide it until the center of the small ellipse in which it swings is over the point.)

M. Level the instrument

(NOTE: At this point you would level the instrument according to the procedure in Job Sheet #1.)

(CAUTION: If at all possible, never set up instrument on ice, frozen ground, asphalt, or tar. Legs will slowly sink and will throw the instrument out of level and position.)

N. Sight through instrument to second point B

O. Loosen clamp screw and turn instrument 90° clockwise

P. Set stake and tack at point C by measuring the given distance from point A to point C

Q. Move instrument to point B

R. Reset instrument by sighting through instrument to point A

S. Loosen clamp screw and turn instrument 90° counterclockwise

T. Set stake and tack at point D by measuring the given distance from point B and point C

BUILDER'S LEVEL AND TRANSIT
UNIT I

JOB SHEET #3--PERFORM A DIFFERENTIAL LEVELING JOB

I. Tools and equipment

- A. Instrument (level)
- B. Leveling rod
- C. Tripod
- D. Field book or pad of paper and pencil

II. Procedure

- A. Establish where to set instrument and determine difference in elevation between points A and D (Figure 1)

  (NOTE: Do not set up over 150' to 200' away from each point.)

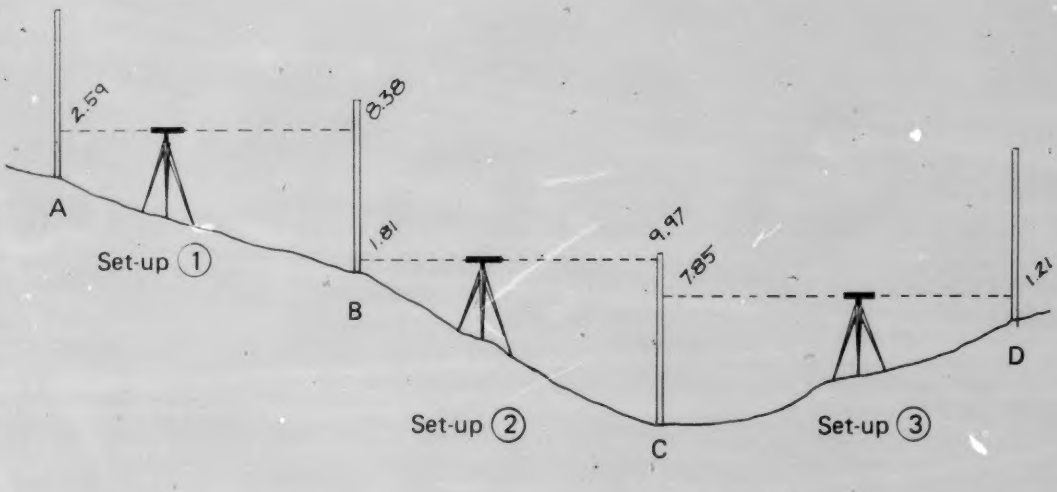
- B. Set up the builder's level

  (NOTE: See Job Sheet #1)

- C. Read leveling rod (Figure 1)

  (NOTE: This is held by a co-worker.)

FIGURE 1



JOB SHEET #3

1. Line of sight at A is 2.59 from setup one
2. Line of sight at B is 8.38 from setup one
3. Record these readings on pad (Figure 2)

FIGURE 2

SETUP	+SIGHT	-SIGHT
1	2.59	8.38

(NOTE: Plus [+] sight is the rod reading from point to line of sight. Minus [-] sight is the rod reading from line of sight to the point.)

D. Establish second setup for instrument

E. Set up instrument

(NOTE: See Job Sheet #1)

F. Read measuring rod (Figure 1)

(NOTE: This is held by co-worker.)

1. Line of sight at B is 1.81 from setup two
2. Line of sight at C is 9.97 from setup two
3. Record these readings on pad (Figure 3)

FIGURE 3

SETUP	+SIGHT	-SIGHT
1	2.59	8.38
2	1.81	9.97

G. Establish third setup for instrument

JOB SHEET #3

H. Set up instrument

(NOTE: See Job Sheet #1)

I. Read measuring rod (Figure 1)

(NOTE: This is held by co-worker.)

1. Line of sight at C is 7.85 from setup three
2. Line of sight at D is 1.21 from setup three
3. Record these readings on pad (Figure 4)

FIGURE 4

SETUP	+SIGHT	-SIGHT
1	2.59	8.38
2	1.81	9.97
3	7.85	1.21
SUM	12.25	19.56

(NOTE: Total [+] sight column and [-] sight column, then subtract smaller number from larger [12.25 from 19.56]. This will give you the difference of elevation. Point D is lower than point A by 7.31.)

BUILDER'S LEVEL AND TRANSIT
UNIT I

TEST

NAME ________________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the correct numbers in the blanks provided.

______a. Rod used in leveling with the builder's level and usually graduated in tenths and hundredths of a foot

______b. Plot of ground on which a project is to be constructed

______c. Pertaining to the slope of a line, such as inches of fall per foot of run

______d. Permanent point of known or assumed elevation

______e. Proposed or future level of ground at construction line

______f. Stake driven into the ground locating the proposed grade

______g. Vertical distance from the bench mark to the line of sight of the instrument

______h. Serves as elevation reference point

______i. Level line through the instrument as viewed by the eye; place where vertical hair crosses the horizontal hair

______j. Scale on rod adjusted to height of instrument elevation and direct surface elevation and read by instrument person

______k. Method of leveling by which the difference in elevation between two points is determined by "+" (plus) and "-" (minus) rod readings which are totaled and adjusted to the bench mark

______l. Instrument used for surveying; designed and used for measuring both horizontal and vertical angles

______m. Art or science of determining the area and configuration of portions of the surface of the earth

1. Bench mark (BM)
2. Site
3. Line of sight
4. Fall
5. Grade line
6. Grade stake
7. Leveling rod
8. Height of instrument (HI)
9. Self-reading rod
10. Differential leveling
11. Temporary bench mark (TBM)
12. Surveying
13. Transit
14. Builder's level
15. Elevation
16. Laser beam instrument
17. Plumb bob

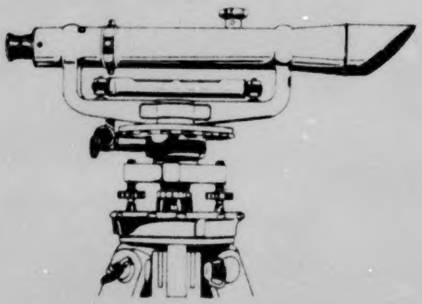
_____n. Instrument consisting of a telescope, leveling bubble, and tripod used primarily for establishing grade levels

_____o. Tool or device attached to a string; used to set and/or check the plumb or perpendicular of a surface

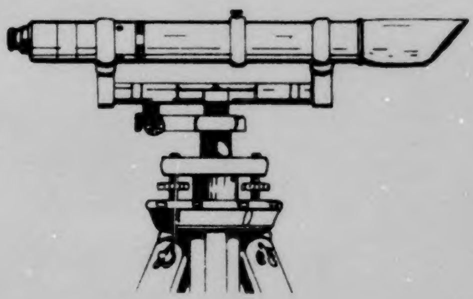
_____p. Automatic leveling instrument which uses a laser beam to establish elevation readings

_____q. Given grade

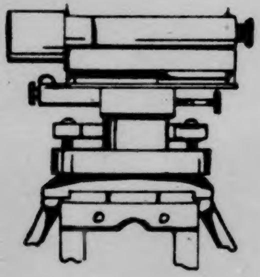
2. Identify the following types of levels.



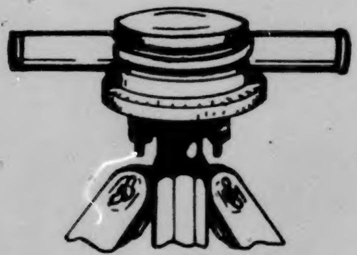
a. ______________________________



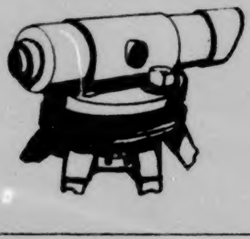
b. ______________________________



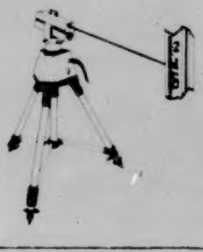
c. ______________________________



d. ______________________________



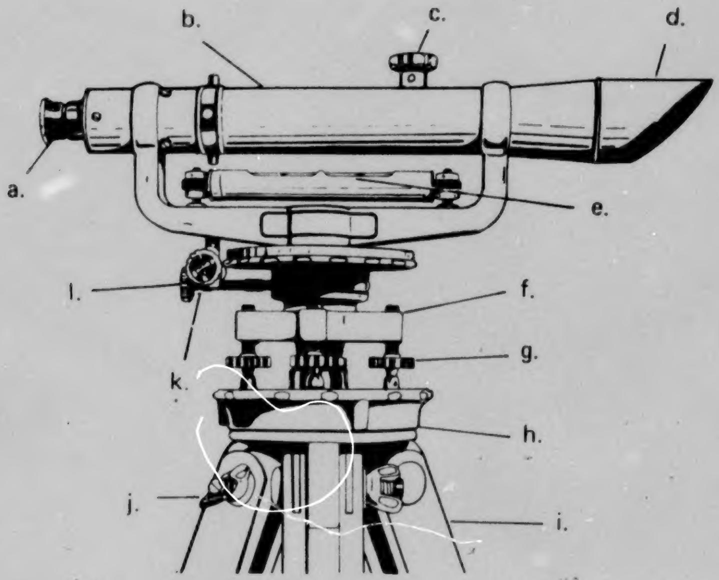
e. ______________________________



f. ______________________________

3. Discuss the types of self-reading rods.

4. Identify the parts of the builder's level by writing the correct names in the blanks.



a. ____________________ g. ____________________

b. ____________________ h. ____________________

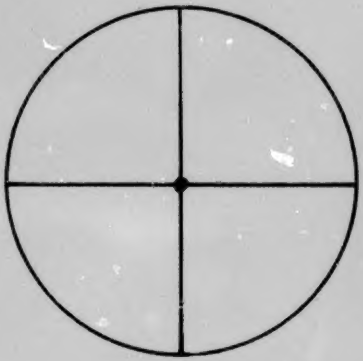
c. ____________________ i. ____________________

d. ____________________ j. ____________________

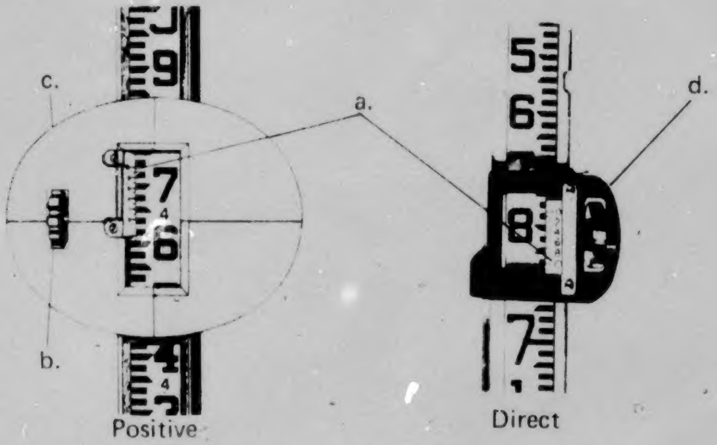
e. ____________________ k. ____________________

f. ____________________ l. ____________________

5. Distinguish between the vertical cross hair and the horizontal cross hair by placing an "X" on the line indicating the vertical cross hair.



6. Identify the parts of the leveling rod by writing the appropriate names in the blanks provided.



a. ______________________ c. ______________________

b. ______________________ d. ______________________

7. Match the parts of the rod on the right to their correct uses by placing the appropriate numbers in the blanks provided.

______a. Red and white disc on rod used for certain types of readings

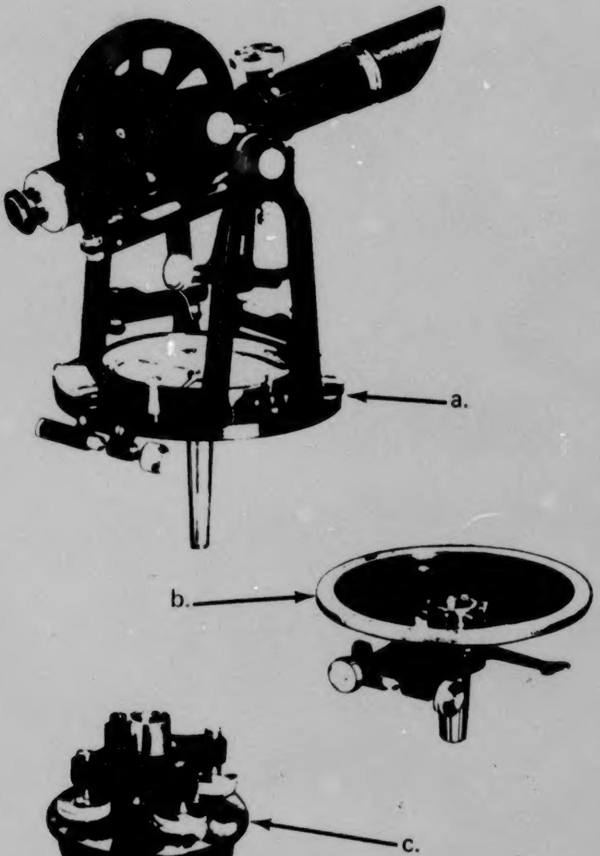
______b. Holds the target in place

______c. Holds the rod when extended

______d. Found on target face and rod clamp; enables reading to the nearest thousandth of a foot

1. Rod clamp
2. Target clamp
3. Vernier scale
4. Target face

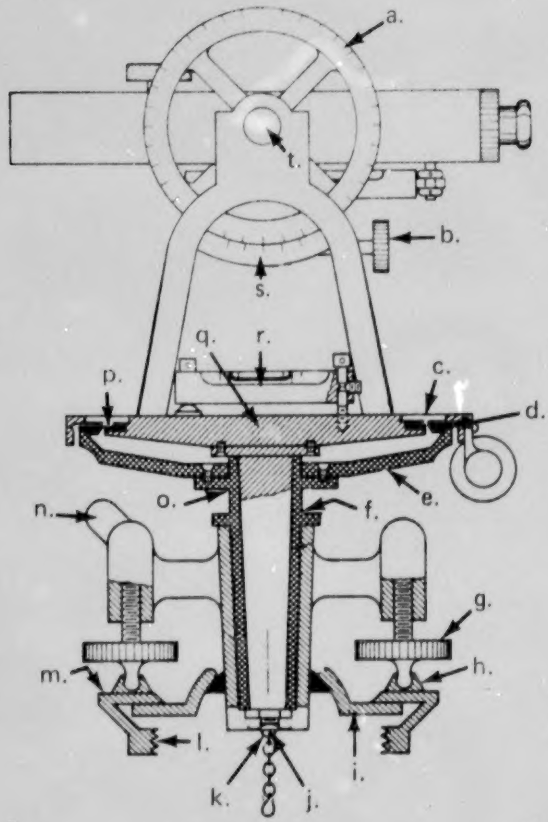
8. Identify the fundamental parts of a transit by writing the appropriate names in the blanks provided.



a. ______________________ b. ______________________

c. ______________________

9. Identify the specific parts of the transit shown below by writing the correct names in the blanks.


a.
t.
b.
s.
q.
r.
p.
c.
d.
e.
o.
f.
n.
g.
h.
m.
l.
i.
k.
j.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

g. ____________________

h. ____________________

i. ____________________

j. ____________________

k. ____________________

l. ____________________

m. ____________________

n. ____________________

o. ____________________

p. ____________________

q. ____________________

r. ____________________

s. ____________________

t. ____________________

10. List five rules to follow in providing care of the instrument.

   a. ____________________

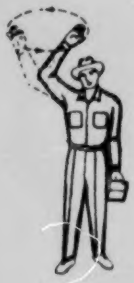
   b. ____________________

   c. ____________________

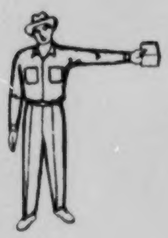
   d. ____________________

   e. ____________________

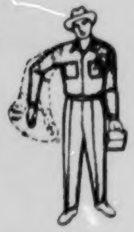
11. Identify the hand motions used by the instrument person to guide the target person.



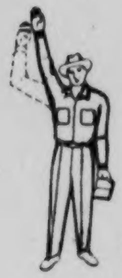
a. ____________________



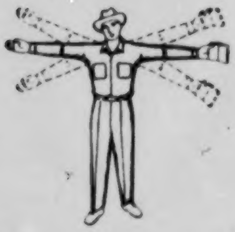
b. ____________________



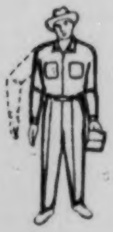
c. ____________________



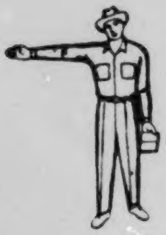
d. ____________________



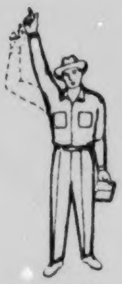
e. ____________________



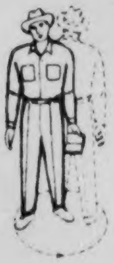
f. ____________________



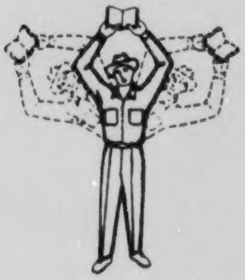
g. ____________________



h. ____________________



i. ____________________



j. ____________________

12. Read the self-reading rod (positive reading).

13. Demonstrate the ability to:

    a. Set up and adjust the builder's level.

    b. Set up and adjust the transit over a point and establish lines with two points given.

    c. Perform a differential leveling job.

    (NOTE: If activities twelve and thirteen have not been accomplished prior to the test, ask your instructor when they should be completed.)

BUILDER'S LEVEL AND TRANSIT
UNIT I

ANSWERS TO TEST

1. a. 7
   b. 2
   c. 4
   d. 1
   e. 5
   f. 6
   g. 8
   h. 11
   i. 3
   j. 9
   k. 10
   l. 13
   m. 12
   n. 14
   o. 17
   p. 16
   q. 15

2. a. Builder's
   b. Engineer's dumpy
   c. Engineer's wild tilting
   d. Turret
   e. Engineer's zeiss
   f. Laser beam instrument

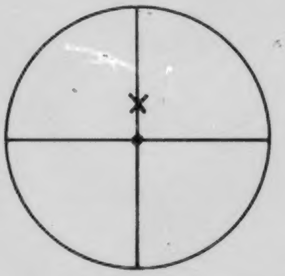
3. Discussion should include:

   a. Positive reading--Gives difference in elevation between HI and elevation of the ground where shot is being taken

   b. Direct reading--Adjust the rod to true elevation and any reading taken through the instrument at this point would automatically be the true elevation

4. a. Eyepiece
   b. Telescope barrel
   c. Focusing screw
   d. Sun shade
   e. Bubble tube
   f. Leveling head
   g. Leveling screw
   h. Head plate
   i. Tripod
   j. Leg thumb nut
   k. Slow motion screw
   l. Clamp

5.



6. a. Vernier scale
   b. Target clamp
   c. Target face
   d. Rod clamp
7. a. 4
   b. 2
   c. 1
   d. 3
8. a. Alidade
   b. Circle
   c. Leveling head
9. a. Vertical circle
   b. Vertical tangent screw for focusing on object sighted
   c. Window, glass
   d. Graduations of horizontal circle
   e. Horizontal circle (lower plate)
   f. Lower clamp drum contact
   g. Leveling screw
   h. Shoe
   i. Shifting plate
   j. Center of half ball
   k. Half ring
   l. Threads for tripod
   m. Footplate
   n. Nub for lower clamp
   o. Upper clamp drum contact
   p. X vernier
   q. Upper plate

- r. Plate level
- s. Vertical-circle vernier
- t. Elevation or horizontal axis

10. Any five of the following:
    - a. Protect against shock and vibration during transport
    - b. Keep in case except when in use
    - c. Place lens and tripod cap in box after removing from instrument
    - d. Attach instrument onto tripod carefully and firmly before moving tripod
    - e. Always use sun shade regardless of the weather
    - f. Clean lenses with soft tissue
    - g. Loosen set screws when not in use
11.
    - a. Turning point
    - b. Move rod in this direction (left)
    - c. Come in
    - d. Use long rod
    - e. Observation completed; move on; understood
    - f. Move down
    - g. Move in this direction (right)
    - h. Move up
    - i. Wrong face; check clamp; rod upside down
    - j. Wave rod from side to side
12. Evaluated to the satisfaction of the instructor
13. Performance skills evaluated to the satisfaction of the instructor

SITE LAYOUT
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to locate building lines from a set of datum and lay out and set batter boards and building lines. The student should also be able to square a building using the 3-4-5 rule method, the diagonal method, and the transit. This knowledge will be evidenced by completion of the job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with site layout to the correct definitions.
2. List surface aspects of the site that concern the planner.
3. List factors that are pertinent to the site layout.
4. Locate the building lines on a plot plan from a set of datum.
5. Draw the methods of squaring a building.
6. State the purpose of batter boards.
7. Name the common errors that contribute to incorrect measurements.
8. Demonstrate the ability to:
    a. Erect batter boards and locate building lines.
    b. Locate building line points on batter boards using a transit.

SITE LAYOUT
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information and job sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in the job sheets.

  G. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Plot Plan

    2. TM 2--Squaring a Building

    3. TM 3--Squaring a Building (Continued)

    4. TM 4--Batter Boards

  D. Assignment Sheet #1--Building Layout

  E. Answers to assignment sheet

  F. Job sheets

    1. Job Sheet #1--Erect Batter Boards and Locate Building Lines

    2. Job Sheet #2--Locate Building Line Points on Batter Boards Using a Transit

  G. Test

  H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

B. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry.* 3rd ed. Chicago: American Technical Society, 1963.

C. Lair, E. A. *Carpentry for the Building Trades.* St. Louis, Missouri: McGraw-Hill, 1953.

D. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Cliffs, New Jersey: Prentice-Hall, 1970.

SITE LAYOUT
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Batter boards--Temporary framework used to assist in locating corners when laying out a foundation
- B. Bench mark (BM)--Metal or stone marker placed in the ground by a surveyor with the elevation indicated on it

  (NOTE: The curb is sometimes used.)
- C. Builder's level--Instrument consisting of a telescope, leveling bubble, and tripod used primarily for establishing grade levels
- D. Transit--Instrument used for surveying; designed and used for measuring both horizontal and vertical angles
- E. Plumb bob--Tool or device attached to a string; used to set and/or check the plumb or perpendicular of a surface
- F. Surveying--Art or science of determining the area and configuration of portions of the surface of the earth
- G. Datum--Information used as a basis for calculating or measuring
- H. Excavating--Removing soil for a footing or to establish a uniform grade
- I. Footing--Enlargement at the lower end of a foundation, wall, pier, or column to distribute the load
- J. Grade line--Proposed or future level of ground at construction line
- K. Grade stake--Stake driven into the ground that locates the finished level of the ground at that point

  (NOTE: This is read from the bench mark.)
- L. Leveling rod--Rod used in leveling with the builder's level and usually graduated in tenths and hundredths of a foot
- M. Property lines--Boundaries of a lot or plot of ground
- N. Plot plan--Drawing used to show the location and size of the structures, driveways, sidewalks, and patios on the lot
- O. Site--Plot of ground on which a project is to be constructed

INFORMATION SHEET

P. Fall--Pertaining to the slope of a line, such as inches of fall per foot of run

Example: 1" fall per 1' of run

Q. Fill--Soil or other substance used to raise the grade level

R. Elevation--Given grade

S. Ledger boards--Top horizontal boards of the batter board construction

T. Saw kerf--Sawed line in which to fit string line to hold it in place

U. Plumb down--Method of plumbing from a given point down to a point below

V. Building permit--Agreement between the builder and a city that specifies the type, quality, and extent of construction to be done

W. Height of instrument (HI)--Vertical distance from the bench mark to the line of sight of the instrument

II. Surface aspects of the site that concern the planner

A. Presence of trees and shrubs

B. Contour of site

C. Elevation of site in relation to the area

D. Size, shape, and proximity of surrounding buildings

E. Soil characteristics

III. Factors pertinent to site layout

A. Local regulations (zoning regulations and restrictions)

Examples: Setback from front property line, proximity to side property lines

B. Location of services

Examples: Sewers, electricity, gas, phone

C. Existing trees and shrubs

D. Shape of terrain

Examples: Flat, rolling, sloping

INFORMATION SHEET

IV. Datum used in laying out building lines (Transparency 1, Assignment Sheet #1)

- A. Dimensions of property
- B. Setback
    - 1. From curb
    - 2. From sidewalk
    - 3. From property line
- C. Distance from side boundaries
- D. Distance from rear of property
- E. Easements
- F. Building size
    - 1. Length
    - 2. Width
- G. Grade and location of bench mark
- H. Orientation of building on lot
    - 1. Square
    - 2. Diagonal

V. Methods of squaring a building (Transparencies 2 and 3)

- A. 3-4-5 rule

    (NOTE: Any multiple of the 3-4-5 rule may be used depending on the size of the building, such as 6-8-10, 12-16-20, or 24-32-40.)

- B. Diagonal method
- C. Transit

VI. Purpose of batter boards--To provide a place of attachment for the string used to locate building lines for excavation and construction (Transparency 4)

INFORMATION SHEET

VII. Common errors that contribute to incorrect measurements

A. Tape not pulled tight enough

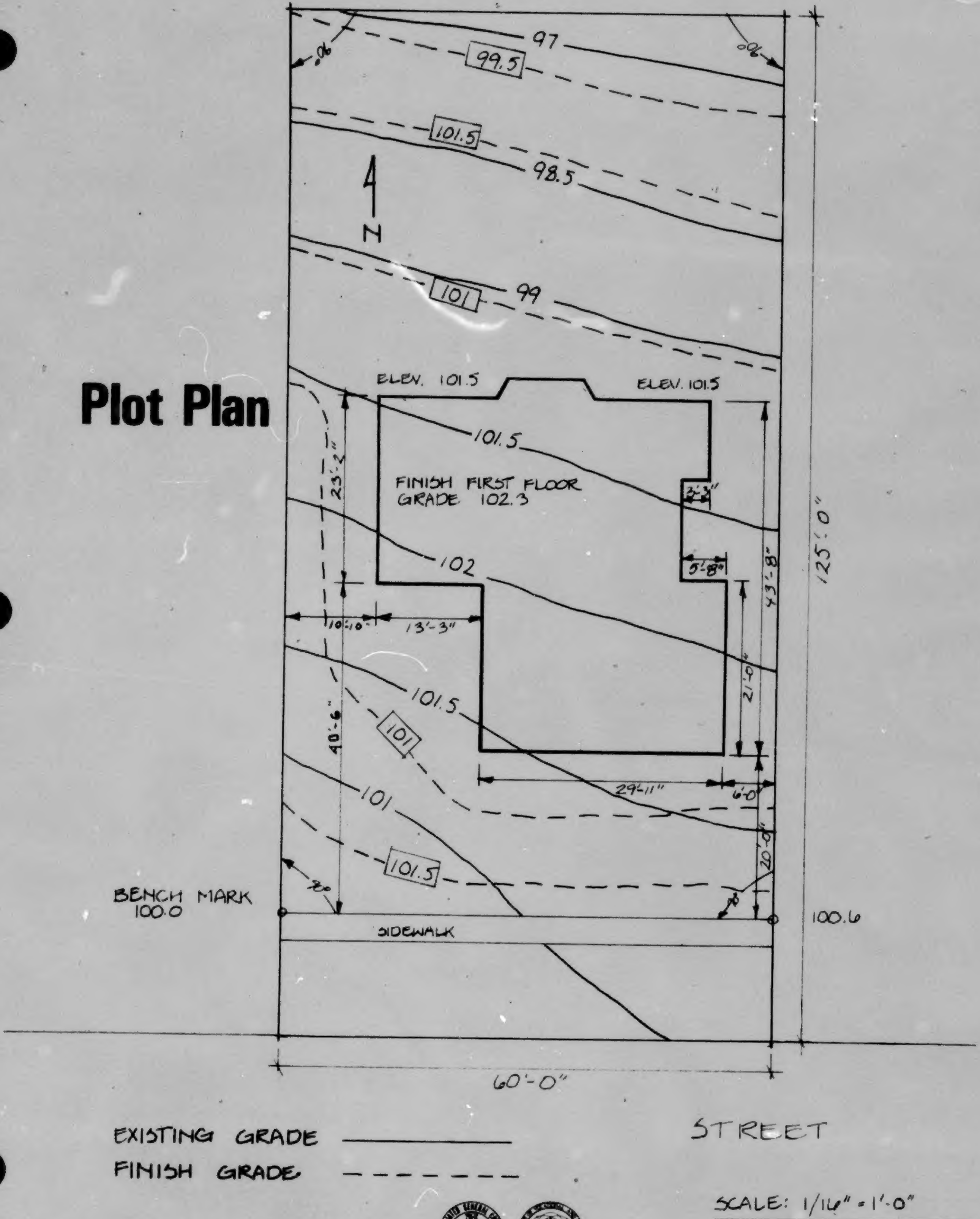
B. Tape not in proper alignment

C. Plumb bob not used when measuring on slope

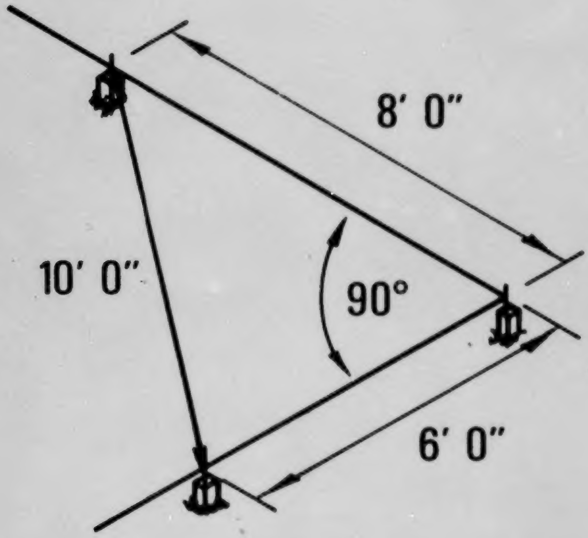
(NOTE: The plumb bob is used to maintain horizontal measurements.)

D. Reading or recording incorrect numbers (human errors)

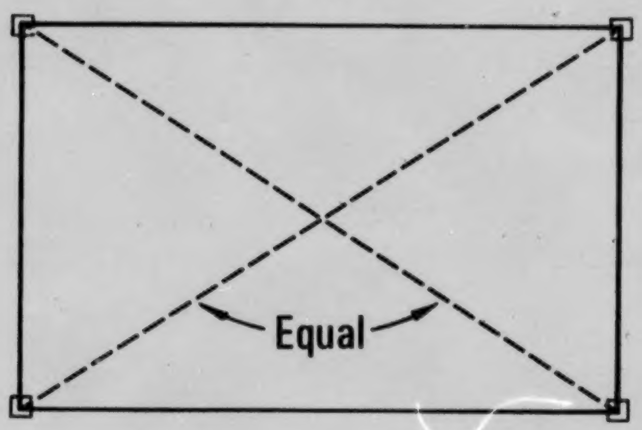
Plot Plan


97
99.5
90°
90°
101.5
98.5
N
101
99
ELEV. 101.5
ELEV. 101.5
101.5
FINISH FIRST FLOOR
GRADE 102.3
23'-2"
2'-3"
102
5'-8"
43'-8"
125'-0"
10'-10"
13'-3"
21'-0"
101.5
101
40'-6"
101
29'-11"
6'-0"
20'-0"
101.5
90°
90°
BENCH MARK
100.0
100.6
SIDEWALK
60'-0"
EXISTING GRADE
FINISH GRADE
STREET
SCALE: 1/16" = 1'-0"

Squaring a Building



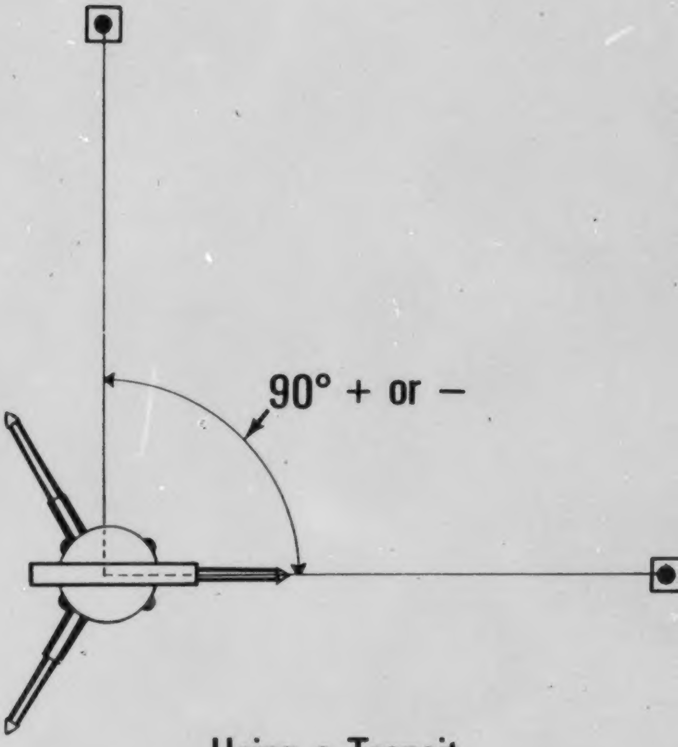
THE 3-4-5 RULE



THE DIAGONAL METHOD

Squaring a Building

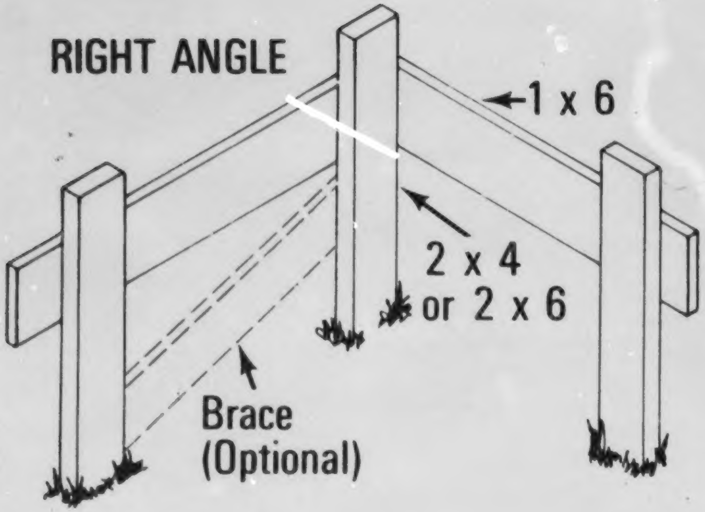
(Continued)



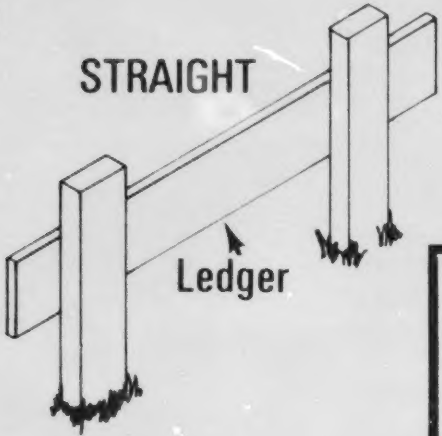
Using a Transit

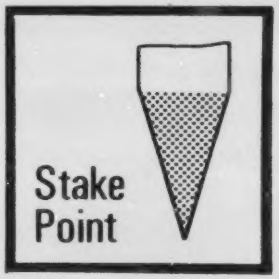
Batter Boards

RIGHT ANGLE

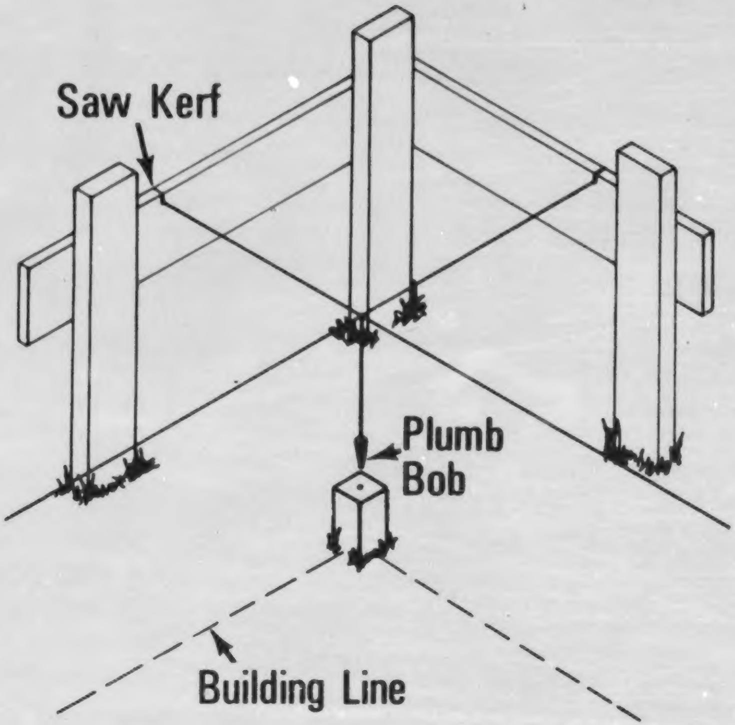

1 x 6
2 x 4
or 2 x 6
Brace
(Optional)

STRAIGHT




Stake
Point

SETTING UP BUILDING LINES


Saw Kerf
Plumb
Bob
Building Line

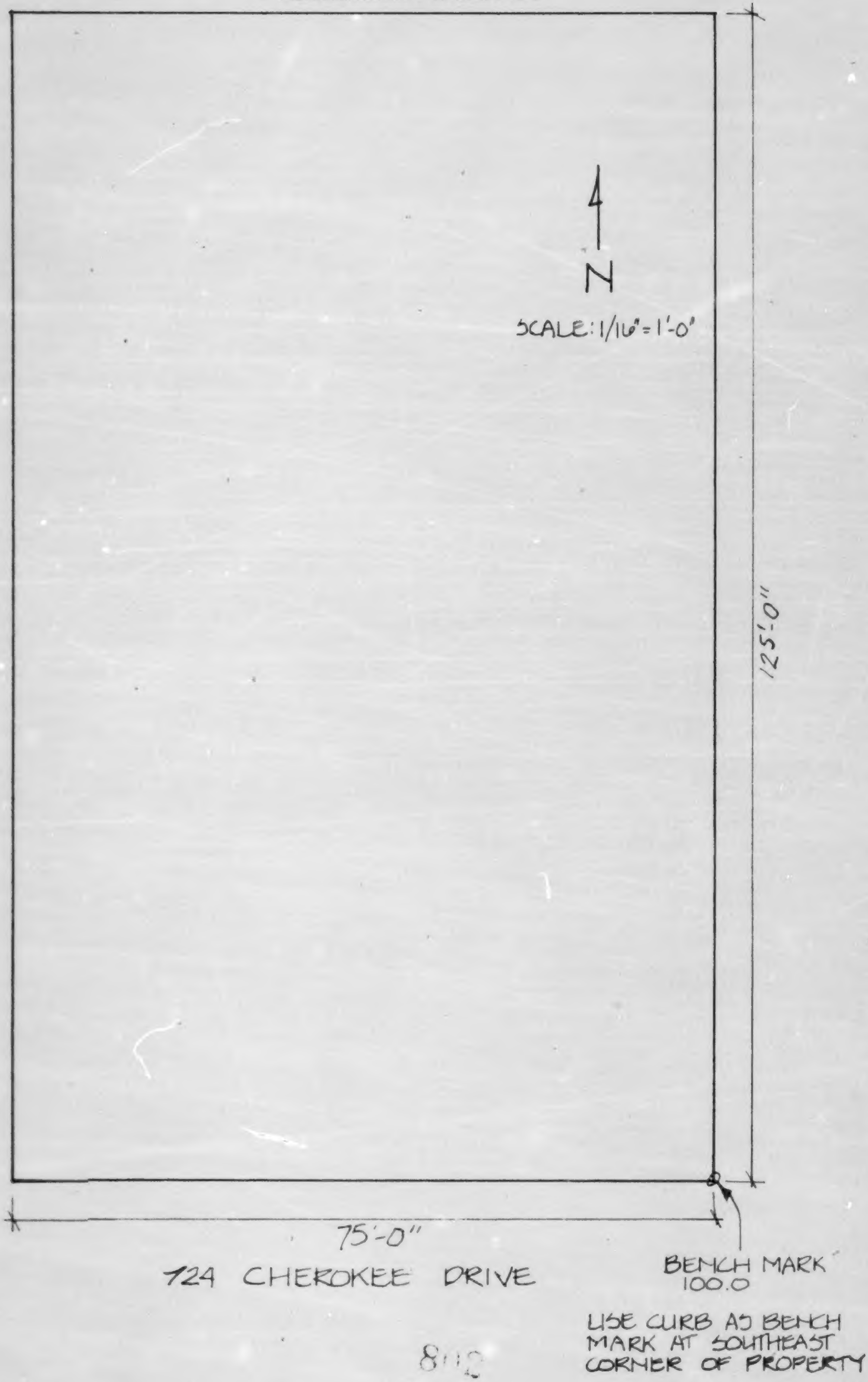
SITE LAYOUT
UNIT II

ASSIGNMENT SHEET #1--BUILDING LAYOUT

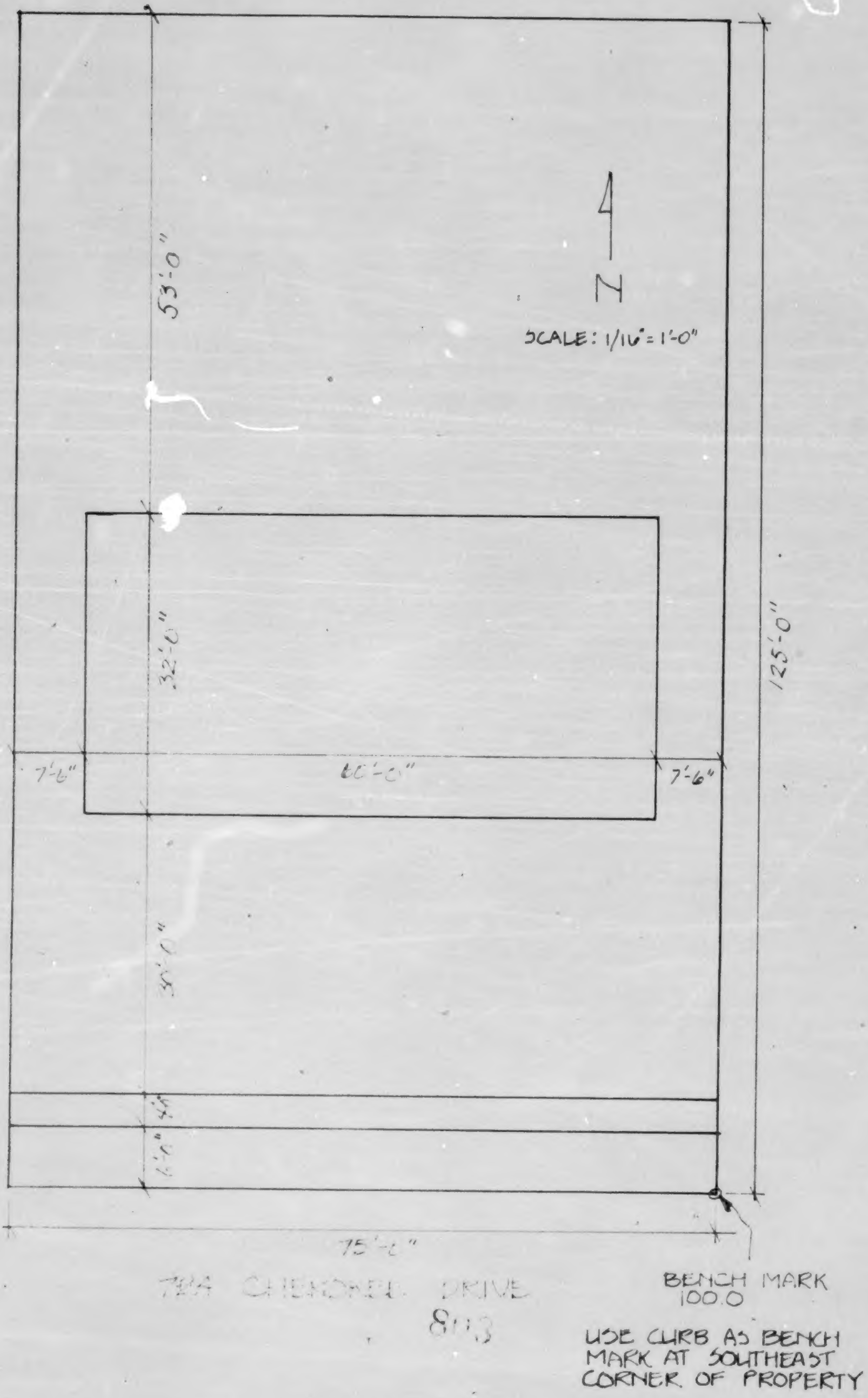
Using the following datum, locate the building lines of given dimensions on the plot using a scale 1/16" = 1' 0".

1. Sidewalk (minimum)
    a. 4' wide
    b. 6' from curb
2. Building lines (minimum)
    a. Front--30' from sidewalk
    b. Sides--7'-6"
    c. Rear--53'-0"
3. Easements--10' at rear for alley
4. Building size
    a. Length--60', east and west
    b. Width--32', north and south
5. Grade (minimum) at building line--100.0
6. Orientation--Front of building parallel to street and centered between side boundaries

ASSIGNMENT SHEET #1


N
SCALE: 1/16" = 1'-0"
125'-0"
75'-0"
124 CHEROKEE DRIVE
BENCH MARK
100.0
USE CURB AS BENCH
MARK AT SOUTHEAST
CORNER OF PROPERTY

SITE LAYOUT
UNIT II
ANSWERS TO ASSIGNMENT SHEET #1


N
SCALE: 1/16" = 1'-0"
53'-0"
32'-0"
30'-0"
4'-6"
6'-6"
125'-0"
7'-6"
60'-0"
7'-6"
75'-0"
784 CHEROKEE DRIVE
803
BENCH MARK
100.0
USE CURB AS BENCH
MARK AT SOUTHEAST
CORNER OF PROPERTY

SITE LAYOUT
UNIT II

JOB SHEET #1--ERECT BATTER BOARDS AND LOCATE BUILDING LINES

I. Tools and materials needed

A. Tools

1. Sledge hammer
2. Claw hammer
3. Handsaw, crosscut
4. Electric handsaw (if electricity is available on site)
5. Builder's level and/or transit
6. Plumb bob
7. Heavy cord or twine
8. Tape

B. Materials

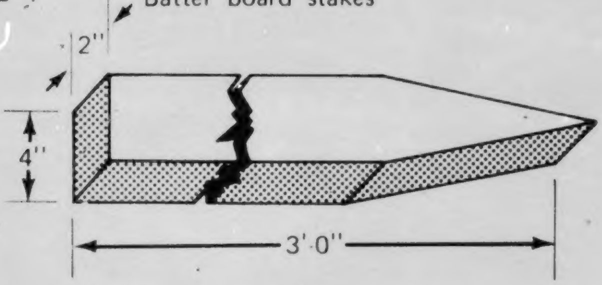
1. Batter board stakes, 2 x 4 x 3'
2. Ledger boards, 1 x 6 x 6'
3. Braces (if necessary), 1 x 4 x 6'
4. Nails, 8d box
5. Corner stakes, 2 x 2 x 1'

II. Procedure

A. Cut material to size

1. Batter board stakes (Figure 1)

FIGURE 1 Batter board stakes

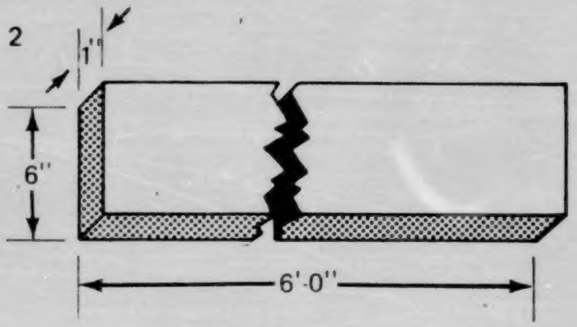


814

JOB SHEET #1

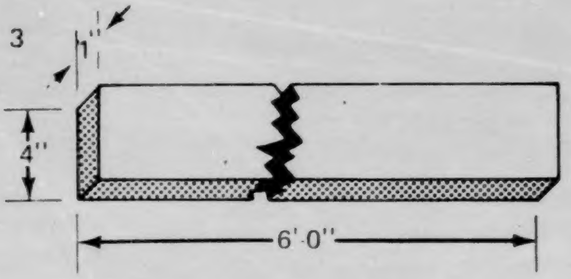
2. Ledger boards (Figure 2)

FIGURE 2



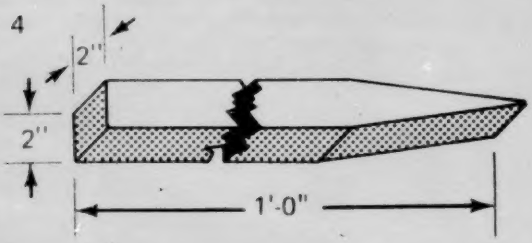
3. Braces (Figure 3)

FIGURE 3



4. Corner stakes (Figure 4)

FIGURE 4

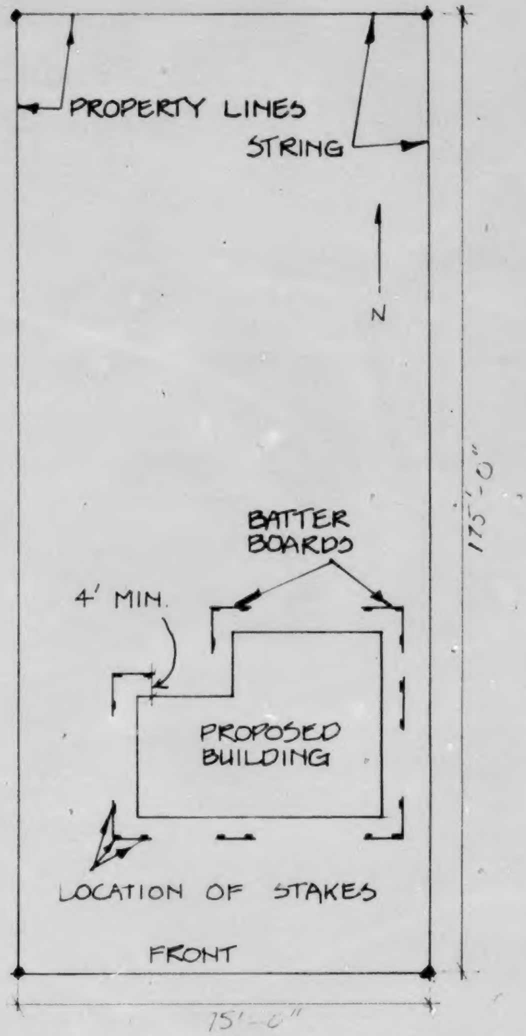


B. Locate property boundary markers

1. Stretch a string along all boundaries
2. Measure from boundary lines and locate building lines
3. Leave string in place until exact building lines have been located on batter boards (Figure 5)

JOB SHEET #1

FIGURE 5


PROPERTY LINES
STRING
N
175'-0"
BATTER BOARDS
4' MIN.
PROPOSED BUILDING
LOCATION OF STAKES
FRONT
75'-0"

C. Locate approximate building lines on lot inside boundary lines

D. Erect batter boards

1. Drive batter board stakes at the corners of the building lines

   a. Place stakes a minimum of four feet outside building lines

      (NOTE: When setting batter boards for large structures, set them back as far as possible, usually 20', to leave work room around the excavation for heavy equipment.)

   b. Use the builder's level to locate the top of all batter boards at the same elevation

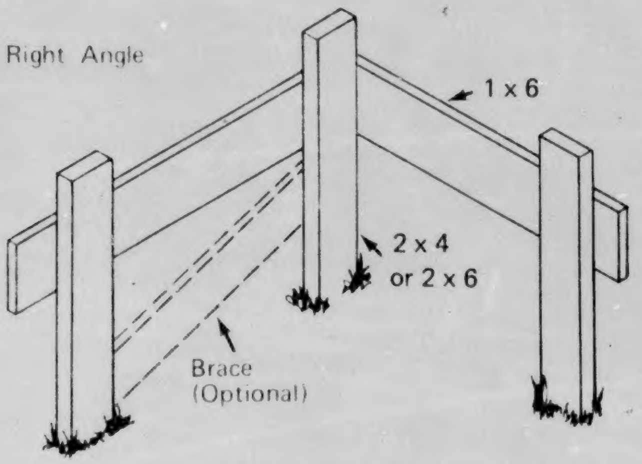
      (NOTE: Use the 2 x 4 x 3' stakes. See Figure 6.)

JOB SHEET #1

2. Attach ledger boards to stakes

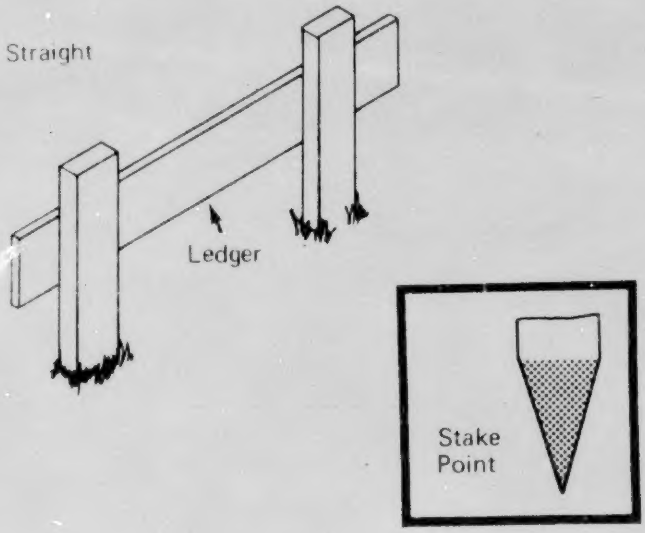
(NOTE: Use the 1 x 6 x 6' boards. See Figures 6a and 6b.)

FIGURE 6a


Right Angle
1 x 6
2 x 4
or 2 x 6
Brace
(Optional)

(NOTE: When the soil is loose or the stakes must be higher than three feet, braces should be used.)

FIGURE 6b


Straight
Ledger
Stake
Point

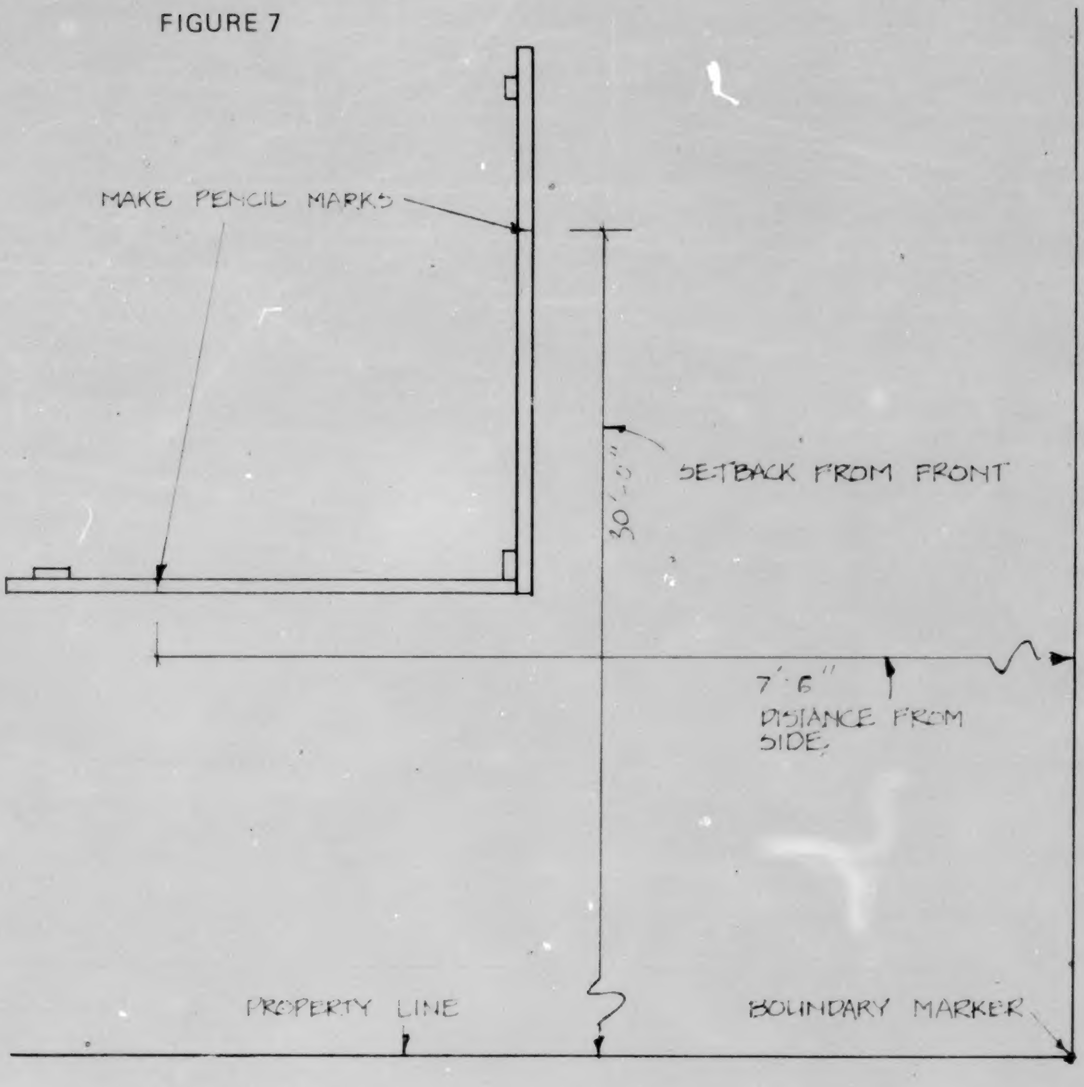
JOB SHEET #1

E. Locate building lines

1. Measure from property lines, as outlined by string, to ledger boards and make a pencil mark on the ledger board (Figure 7)

   (NOTE: Offset line hubs are sometimes set at line locations below the batter board.)

FIGURE 7

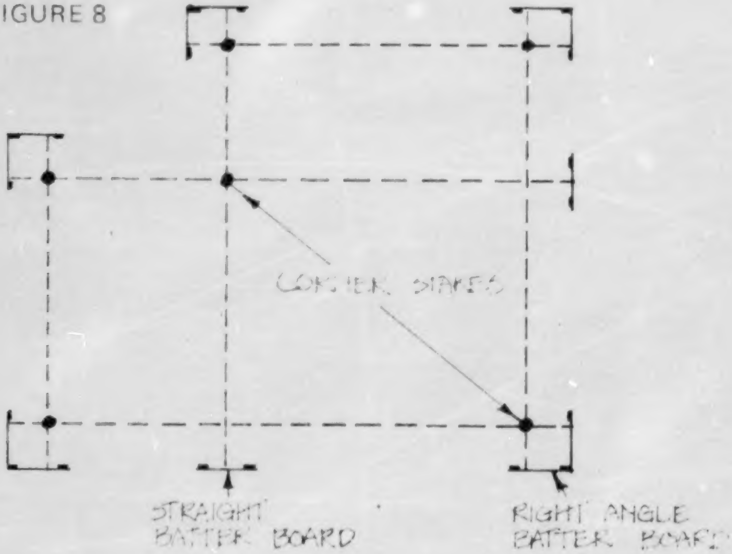

MAKE PENCIL MARKS
SETBACK FROM FRONT
30'-0"
7'-6"
DISTANCE FROM SIDE
PROPERTY LINE
BOUNDARY MARKER

808

JOB SHEET #1

2. Attach string between points on ledger boards to locate building lines (Figure 8)

FIGURE 8

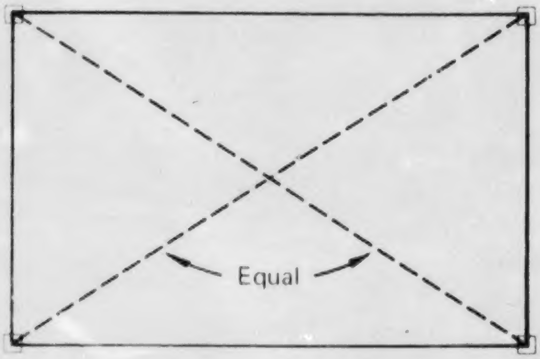

CORNER STAKES
STRAIGHT BATTER BOARD
RIGHT ANGLE BATTER BOARD

3. Square the corners of the building lines

(NOTE: Shift the string on the ledger boards until corners are square.)

a. Diagonal method (Figure 9)

FIGURE 9

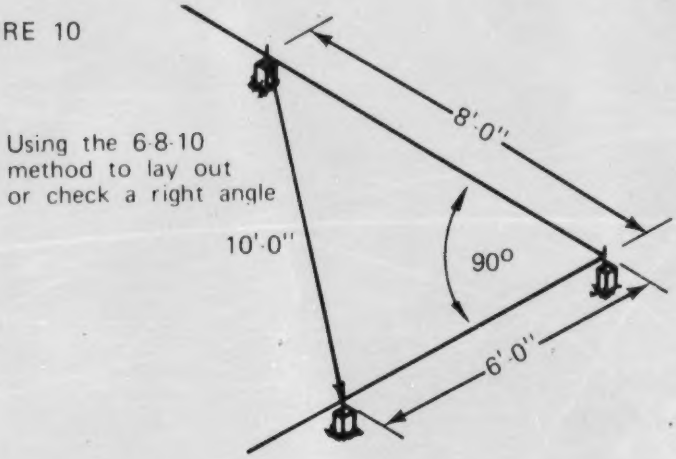


Diagonals of a square or rectangle will be equal in length

b. 3-4-5 rule (Figure 10)

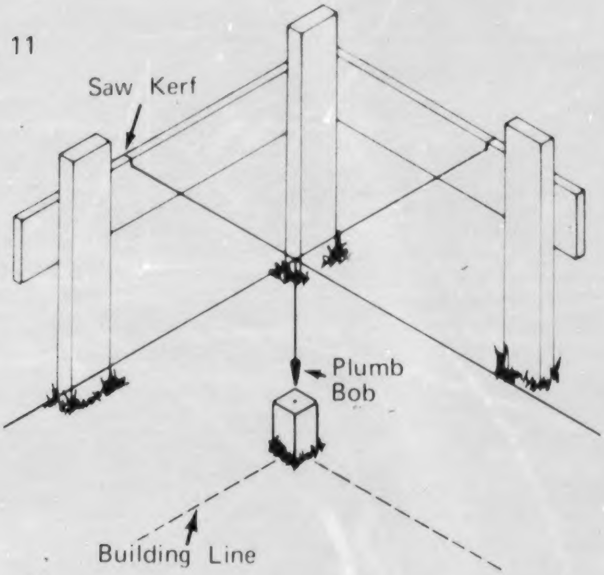
(NOTE: Any multiple of 3-4-5 may be used, such as 6-8-10, 9-12-15, or 12-16-20.)

FIGURE 10


Using the 6-8-10 method to lay out or check a right angle
8'-0"
10'-0"
90°
6'-0"

4. After the exact location of lines are established, saw a kerf in each ledger board at the exact location to keep string from shifting (Figure 11)

FIGURE 11


Saw Kerf
Plumb Bob
Building Line

JOB SHEET #1

F. Locate and drive corner stakes at building lines to establish grade

   1. Plumb down from the intersection of the string at each corner of the building lines

   2. Drive a corner stake at this location (Figure 11)

      a. Use plumb bob to locate the position of the stake

      b. Use builder's level to establish grade

      c. Drive a nail in the top of each stake to locate the exact point of intersection

G. Remove the string from around property lines

SITE LAYOUT
UNIT II

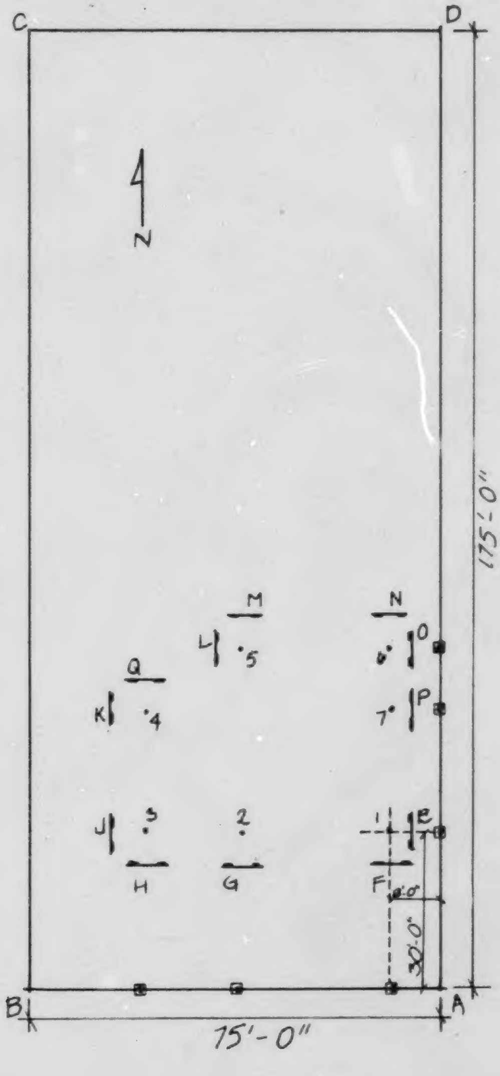
JOB SHEET #2--LOCATE BUILDING LINE POINTS ON BATTER BOARDS USING A TRANSIT

I. Tools and equipment

- A. Transit
- B. Tripod
- C. Tape
- D. Claw hammer
- E. Surveyor tacks
- F. Sledge hammer
- G. Stakes
- H. Plumb bob

II. Procedure

Batter Board Layout

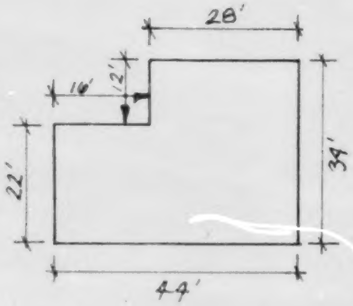

C
D
N
175'-0"
M
N
L
5
6
O
Q
K
4
7
P
J
3
2
1
E
H
G
F
10'-0"
30'-0"
B
A
75'-0"

SCALE: 1/32" = 1'-0"

JOB SHEET #2

(NOTE: Property line points A, B, C, and D are established. Batter boards are set for building on a lot 75' x 175'. Setback is 30' from south boundary and 8' from east boundary. Building dimensions are shown below. See Figure 2.)

FIGURE 2



A. Set instrument on point A and establish lines A and B; measure over 8' from point A, set stake, and tack

B. Measure accurately along AB distances of 8', 36', and 52' from A (Figure 1)

   1. Drive a stake at each location
   2. Set a tack in top of each stake exact distance from A

C. Measure accurately along AD distances of 30', 52', and 64' from A

D. Set up instrument over stake on AB 8' from A

   1. Adjust tripod legs until plumb bob point is as close as possible over tack
   2. Slack off levelling screws and move instrument on centering head until plumb bob is exactly over tack

E. Level instrument

F. Recheck plumb bob and reset if necessary

G. Check stakes

   1. Unlock horizontal locking lever
   2. Tilt telescope downward and sight on tack at B
   3. Tighten both horizontal and vertical motion clamp screws

      (CAUTION: DO NOT overtighten screws.)

JOB SHEET #2

4. Turn horizontal circle until 0° coincides exactly with center mark on the vernier

5. Loosen clamp screw and turn instrument 90° clockwise

6. Tighten clamp screw again and, using tangent screw, make final adjustment to 90°

   (CAUTION: DO NOT overtighten screws.)

7. Loosen vertical motion clamp screw

8. Adjust tilt of telescope and site across top of bar at F

9. Mark top edge of batter boards with pencil at line of sight

10. At same position mark batter board at N

H. Mark remainder of batter boards in same method from positions established along AB and AD

SITE LAYOUT
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match terms on the right to the correct definitions on the left by placing the appropriate numbers in the blanks provided. Terms and definitions are continued on the next page.

______a. Temporary framework used to assist in locating corners when laying out a foundation

______b. Metal or stone marker placed in the ground by a surveyor with the elevation indicated on it

______c. Instrument consisting of a telescope, leveling bubble, and tripod used primarily for establishing grade levels

______d. Instrument used for surveying; designed and used for measuring both horizontal and vertical angles

______e. Tool or device attached to a string; used to set and/or check the plumb or perpendicular of a surface

______f. Art or science of determining the area and configuration of portions of the surface of the earth

______g. Information used as a basis for calculating or measuring

______h. Removing soil for a footing or to establish a uniform grade

______i. Enlargement of the lower end of a foundation, wall, pier, or column to distribute the load

______j. Proposed or future level of ground at construction line

______k. Stake driven into the ground that locates the finished level of the ground at that point

______l. Rod used in leveling with the builder's level and usually graduated in tenths and hundredths of a foot

1. Excavating
2. Surveying
3. Batter boards
4. Footing
5. Bench mark (BM)
6. Transit
7. Builder's level
8. Plumb bob
9. Datum
10. Leveling rod
11. Grade stake
12. Grade line

_____m. Boundaries of a lot or plot of ground

_____n. Drawing used to show the location and size of the structures, driveways, sidewalks, and patios on the lot

_____o. Plot of ground on which a project is to be constructed

_____p. Pertaining to the slope of a line, such as inches of fall per foot of run

_____q. Soil or other substance used to raise the grade level

_____r. Given grade

_____s. Top horizontal boards of the batter board construction

_____t. Sawed line in which to fit string line to hold it in place

_____u. Method of plumbing from a given point down to a point below

_____v. Agreement between the builder and a city that specifies the type, quality, and extent of construction to be done

_____w. Vertical distance from the bench mark to the line of sight of the instrument

13. Elevation
14. Fill
15. Plot plan
16. Fall
17. Property lines
18. Site
19. Building permit
20. Plumb down
21. Height of instrument (HI)
22. Ledger boards
23. Saw kerf

2. List three surface aspects of the site that concern the planner.

a. ______________________________

b. ______________________________

c. ______________________________

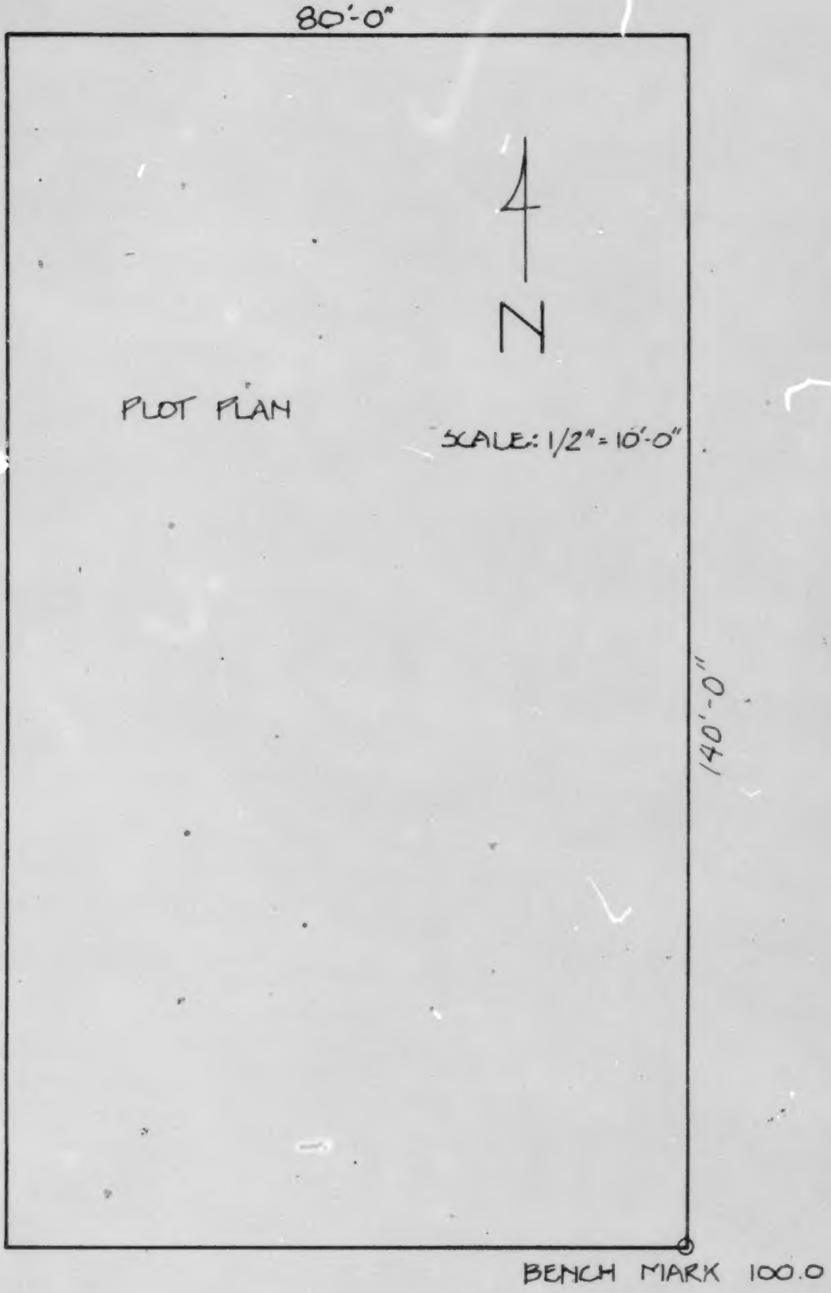
3. List three factors that are pertinent to site layout.

a. ______________________________

b. ______________________________

c. ______________________________

4. Locate the building lines on the plot plan on the following page from the datum given below.
    - a. Sidewalk
        - 1) Four feet wide
        - 2) Six feet from curb
        - 3) Four inches thick
    - b. Building lines
        - 1) Front setback--30 feet from back of sidewalk
        - 2) Sides--Set in 6 feet
        - 3) Rear--Set in 68 feet
    - c. Easements--Ten feet at rear for alley
    - d. Building dimensions
        - 1) Length--68 feet, east and west
        - 2) Width--32 feet, north and south
    - e. Orientation--Front of building parallel to the street and centered between the side boundaries


80'-0"
N
PLOT PLAN
SCALE: 1/2" = 10'-0"
140'-0"
BENCH MARK 100.0

1724 MOHAWK BLD.

5. Draw the methods of squaring a building.

a. 3-4-5 rule

SCALE: 1" = 3'-0"

b. Diagonal method

c. Transit

6. State the purpose of the batter boards.

____

____

7. Name the common errors that contribute to incorrect measurements.

a. ____

b. ____

c. ____

d. ____

8. Demonstrate the ability to:

   a. Erect batter boards and locate building lines.

   b. Locate building line points on batter boards using a transit.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

SITE LAYOUT
UNIT II

ANSWERS TO TEST

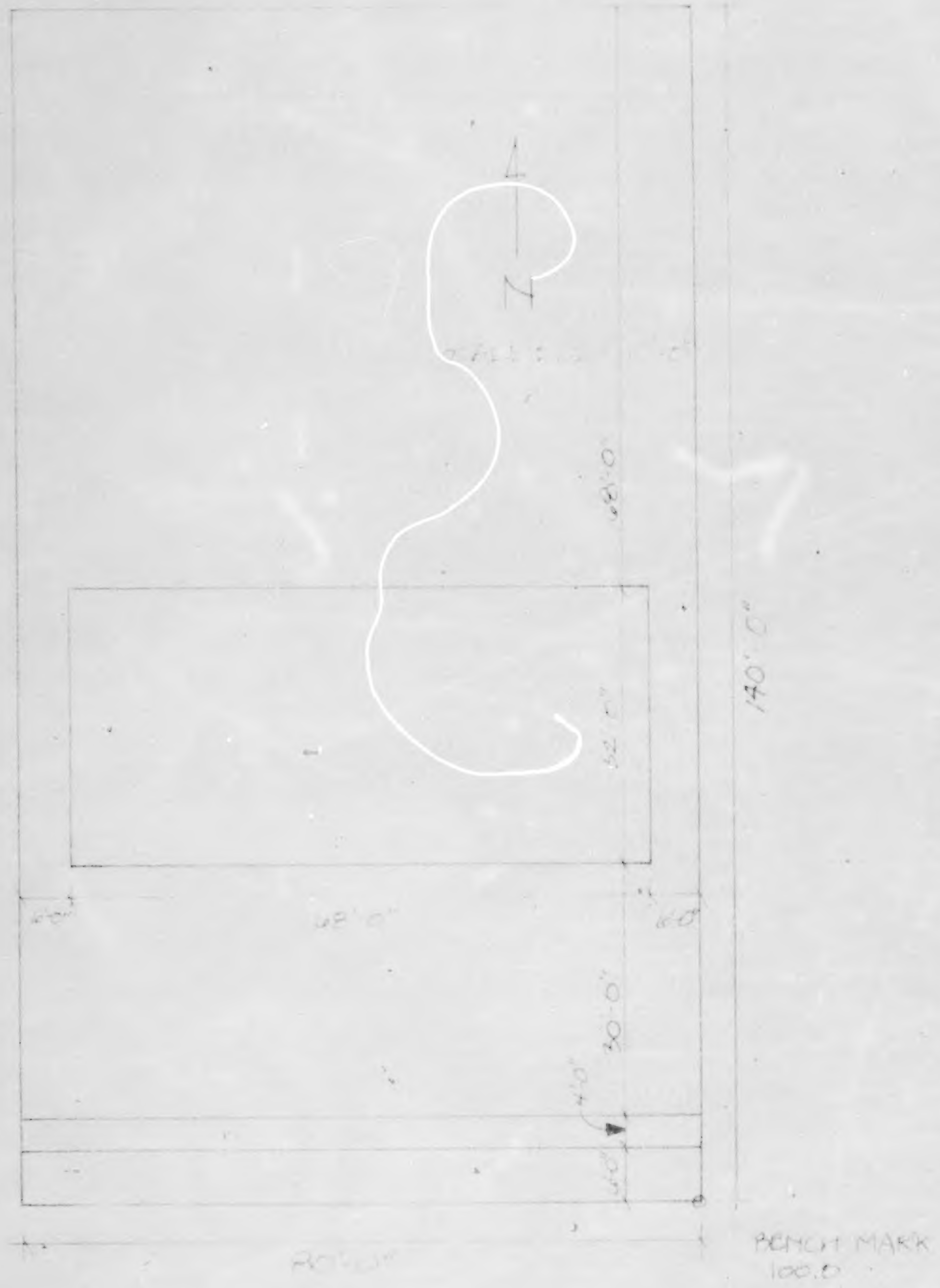
1. a. 3
   b. 5
   c. 7
   d. 6
   e. 8
   f. 2
   g. 9
   h. 1
   i. 4
   j. 12
   k. 11
   l. 10
   m. 17
   n. 15
   o. 18
   p. 16
   q. 14
   r. 13
   s. 22
   t. 23
   u. 20
   v. 19
   w. 21

2. Any three of the following:
   a. Presence of trees and shrubs
   b. Contour of site
   c. Elevation of site in relation to the area
   d. Size, shape, and proximity of surrounding buildings
   e. Soil characteristics

3. Any three of following:
   a. Local regulations (zoning regulations and restrictions)
   b. Location of services
   c. Existing trees and shrubs
   d. Shape of terrain

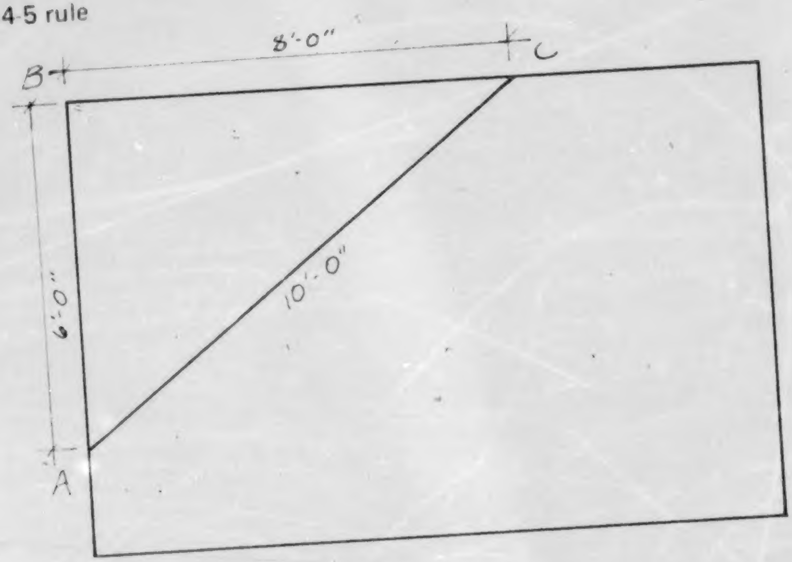
102-F

4.

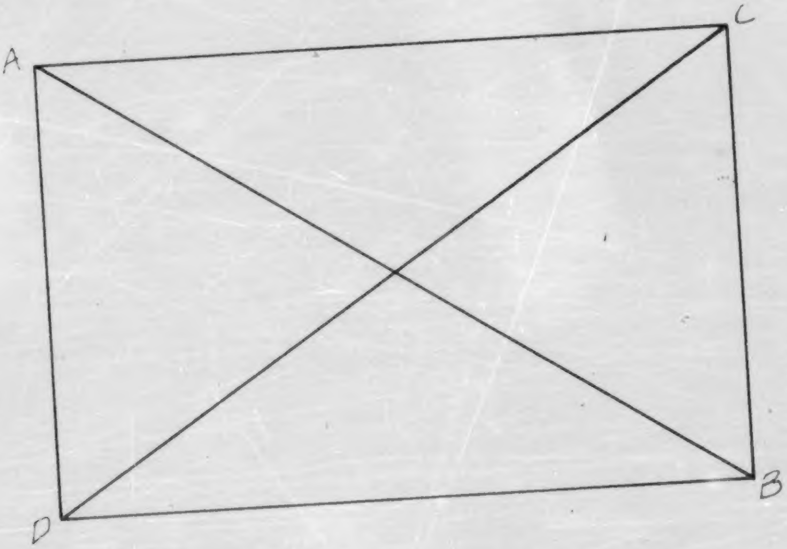

N
68'-0"
32'-0"
140'-0"
6'-0"
48'-0"
6'-0"
30'-0"
4'-0"
4'-0"
80'-0"
BENCH MARK
100.0

1724 MOHAWK BLD

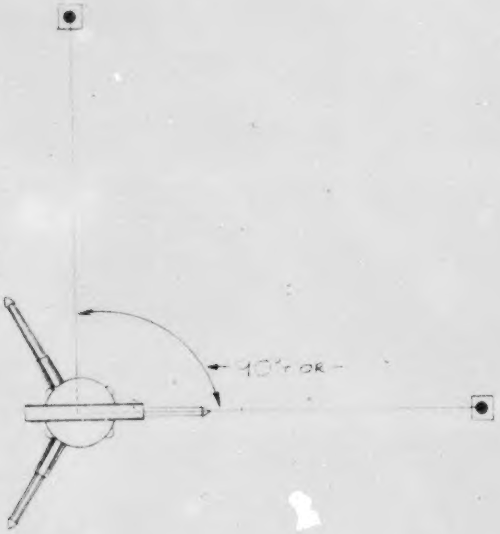
5. a. 3-4-5 rule


8'-0"
C
B
6'-0"
10'-0"
A

b. Diagonal method



c. Transit



6. To provide a place of attachment for the string used to locate building lines for excavation and construction

7. a. Tape not pulled tight enough
   b. Tape not in proper alignment
   c. Plumb bob not used when measuring on slope
   d. Reading or recording incorrect numbers (human errors)

8. Performance skills evaluated to the satisfaction of the instructor

COMMERCIAL CARPENTRY
PROGRESS CHART

Section F
Site

Job	UNIT I BUILDER'S LEVEL AND TRANSIT						UNIT II SITE LAYOUT													
	1	2	3	4	5	6	1	2	3	4	5									
Student's Name	UNIT TEST	Read the Self-Reading Rod (Positive Reading)	Set Up & Adjust Builder's Level	Set Up & Adjust Transit over Point & Establish Lines with Two Points Given	Perform Differential Leveling Job		UNIT TEST	Building Layout	Erect Batter Boards & Locate Building Lines	Locate Building Line Points on Batter Boards Using a Transit										
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

	85% Correct	To Satisfaction of Instructor	Within 1/100 of a Foot @ 50'	Within 1/100 of a Foot @ 50'	Within 1/100 of a Foot @ 50'		85% Correct	To Satisfaction of Instructor	Within 4' of Building Lines; Tops of Ledger Boards Within 1/100' of Same Elevation	Within 1/2" of Exact Side Inset & Front Setback										
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

Section G
Forming

INTRODUCTION TO FORMING
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to write the purpose of forms and match the external factors that affect form design to their effects. The student should be able to identify the parts and types of forms. This knowledge will be evidenced by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with forming to the correct definitions.
2. Write the purpose of forms.
3. Match the external factors that affect form design to their effects.
4. Identify the parts of a form.
5. Identify types of forms.

INTRODUCTION TO FORMING
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information sheet.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Slump Cone

      2. TM 2--Parts of a Form

      3. TM 3--Form Ties

      4. TM 4--Form Ties (Continued)

      5. TM 5--Panelized Forms

      6. TM 6--Built-in-Place Forms

      7. TM 7--Patented Forms

      8. TM 8--Manufactured Form Liners for Special Finish

   D. Test

   E. Answers to test

III. Unit references:

   A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. 2nd ed. Chicago: American Technical Society, 1955.

   B. Smith, Ronald C. *Principles and Practices of Heavy Construction*. Englewood Cliffs: Prentice-Hall, Inc., 1967.

C. Peurifoy, R. L. *Formwork for Concrete Structures*. New York: McGraw-Hill Book Company, 1964.

D. Smith, Ronald C. *Principles and Practices of Light Construction*. 2nd ed. Englewood Cliffs: Prentice-Hall, Inc., 1970.

INTRODUCTION TO FORMING
UNIT I

INFORMATION SHEET

I. Terms and definitions

   A. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure

   B. Cleat--Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

   C. Duplex nail--Double-headed nail used in forming and designed for easy removal

   D. Footing--Enlarged area at the base of a wall or another object used to distribute the weight of the superstructure

   E. Form tie--Wire or metal crosstie used to support pressure of wet concrete and maintain proper wall thickness

   F. Foundation--That portion of a wall upon which the building rests

   G. Grade point--Level of finished concrete in a form

   H. Key--Beveled wood or metal strip placed on the form where future pours will occur

   I. Key way--Groove left in concrete by removal of key

   J. Monolithic pour--Continuous mass of concrete cast as a single unit

   K. Scab--Piece of material nailed across a splice to hold it together and strengthen it

   L. Sheathing--Wide boards, plywood, or metal that make up the face of the form

   M. Spreader--Block of wood that is used to hold the sides of the form apart and is removed as concrete is poured; may also be an integral part of the form tie

   N. Spacer block--Block of wood or other material used as a spacer at offsets in a form

   O. Stakes--Small boards or steel bars sharpened on one end and driven into the ground to support a form

   P. Dowel--Short piece of steel bar inserted through a bulkhead to tie adjoining pours together

   Q. Bulkhead--Board placed in a form to cut off the concrete pour

INFORMATION SHEET

R. Hopper--Receptacle, usually funnel-shaped, open, or with a gate at the bottom

S. Vibrator--Power tool used to consolidate concrete

T. Power buggy--Machine used to transport concrete from the mixer to the pour site

U. Form oil--Paraffin oil or other manufactured product used on a form to prevent adhesion of concrete to the form

V. Water stop--Rubber, neoprene, copper, or some composition material used to prevent passage of water through a joint

W. Reinforcing bars (rebars)--Steel bars used to strengthen concrete walls or beams

(NOTE: Rebar numbers are based on the number of 1/8 inches in the nominal diameter of the bar. A #4 bar is 4/8" or 1/2" in diameter.)

II. Purpose of forms--To hold the wet concrete to the desired shape until it has set

III. Effects of external factors on form design

A. Slump--Greater the slump, the longer it takes concrete to set; therefore, the pressure remains on the forms for a longer period of time (Transparency 1)

B. Rate of pour--Feet of concrete depth poured in one hour

C. Temperature--Affects the rate at which hydration (set) of concrete occurs; the higher the temperature, the faster concrete sets

(NOTE: With a rate of pour of four feet per hour at 70°, the maximum pressure on the form is 550# per square foot. Using the same rate of pour at 50°, the maximum pressure increases to 750 p.s.f.)

D. Vibration--Power vibration can cause pressure to increase 35%

(NOTE: Hand spading has very little effect on pressure.)

E. Method of placement--Concrete weighs 150 pounds per cubic foot; the impact of this weight on concrete already placed causes an increase in pressure on the forms; the greater the height of the drop and the mass of concrete, the greater the pressure increase

(NOTE: High, free drops of concrete cause aggregate separation.)

INFORMATION SHEET

F. Size of form--Thickness and length of the wall are used to figure the rate of pour; height and width have no bearing on pressure on forms, except for the method of placement

(NOTE: For a given rate of fill, the pressure will be the same on a four-inch-wide wall as it is on a twelve-inch-wide wall.)

G. Types of concrete finishes

1. Architectural concrete--Will be exposed in the finished areas of the structure; forms will be designed to give a minimum of deflection and leakage; the concrete surface may be smooth, rough, incised, sculptured, sandblasted, bushhammered, or many other finishes

2. Structural concrete--Will not be exposed in the finished areas of the structure, so some deflection and leakage is permissable

IV. Parts of a form (Transparencies 2, 3, and 4)

A. Sheathing

B. Brace

C. Stake

D. Spreader

E. Cleat

F. Form tie

G. Waler

H. Stud

I. Strongback

J. Sole plate

K. Bottom plate

L. Top plate

M. Bulkhead

N. Key

O. Rustication strip

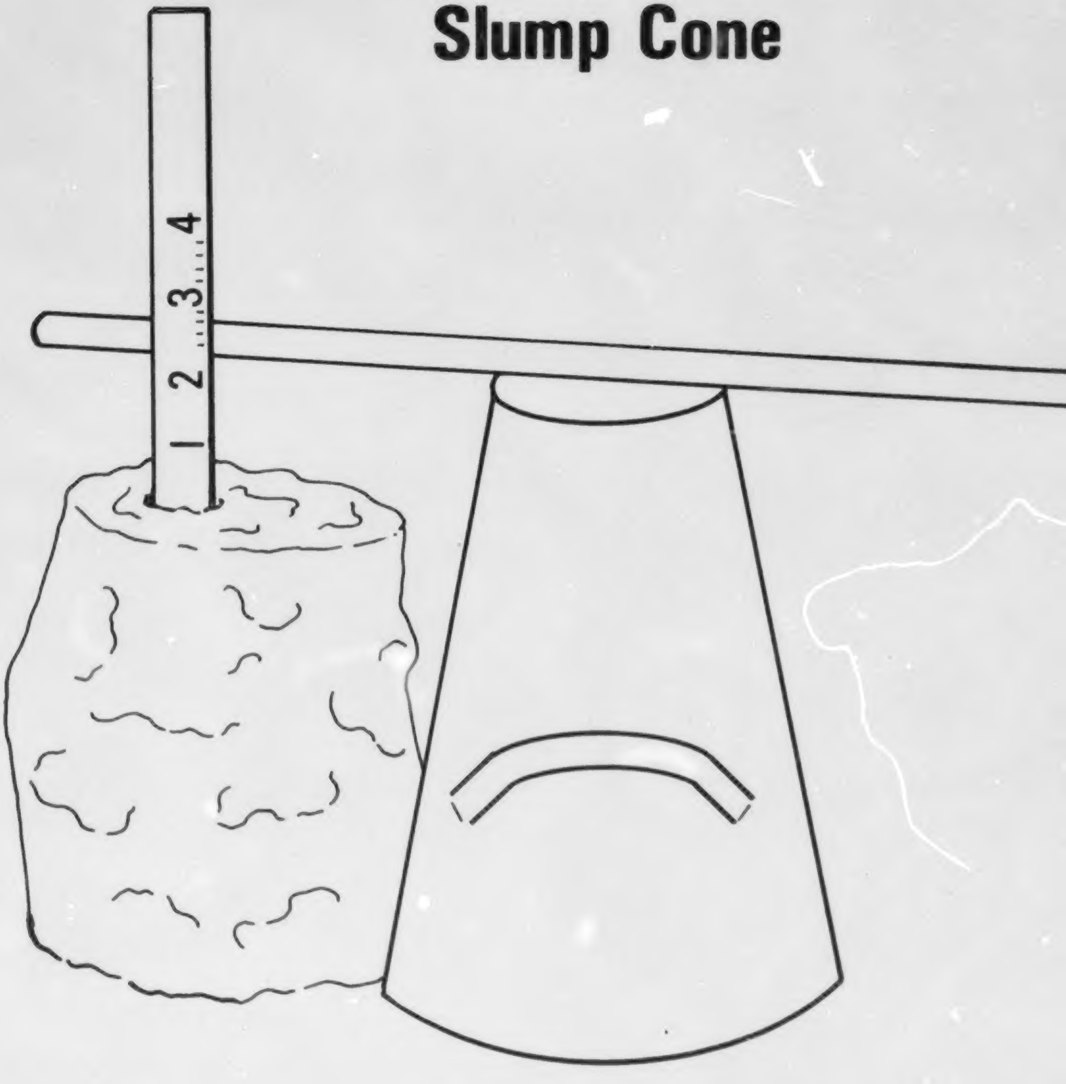
INFORMATION SHEET

- P. Chamfer strip
- Q. Spreader-washer

V. Types of forms (Transparencies 5, 6, 7, and 8)

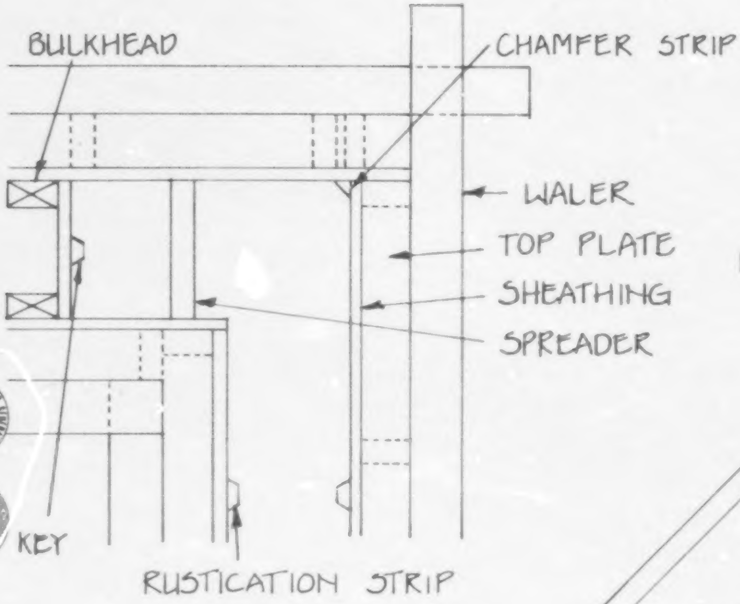
- A. Panelized--Wood
- B. Built-in-place--Wood
- C. Patented--All metal, all wood, a combination of wood and metal or fiberglass
- D. Manufactured forms with predesigned finishes--Fiberglass and other liners

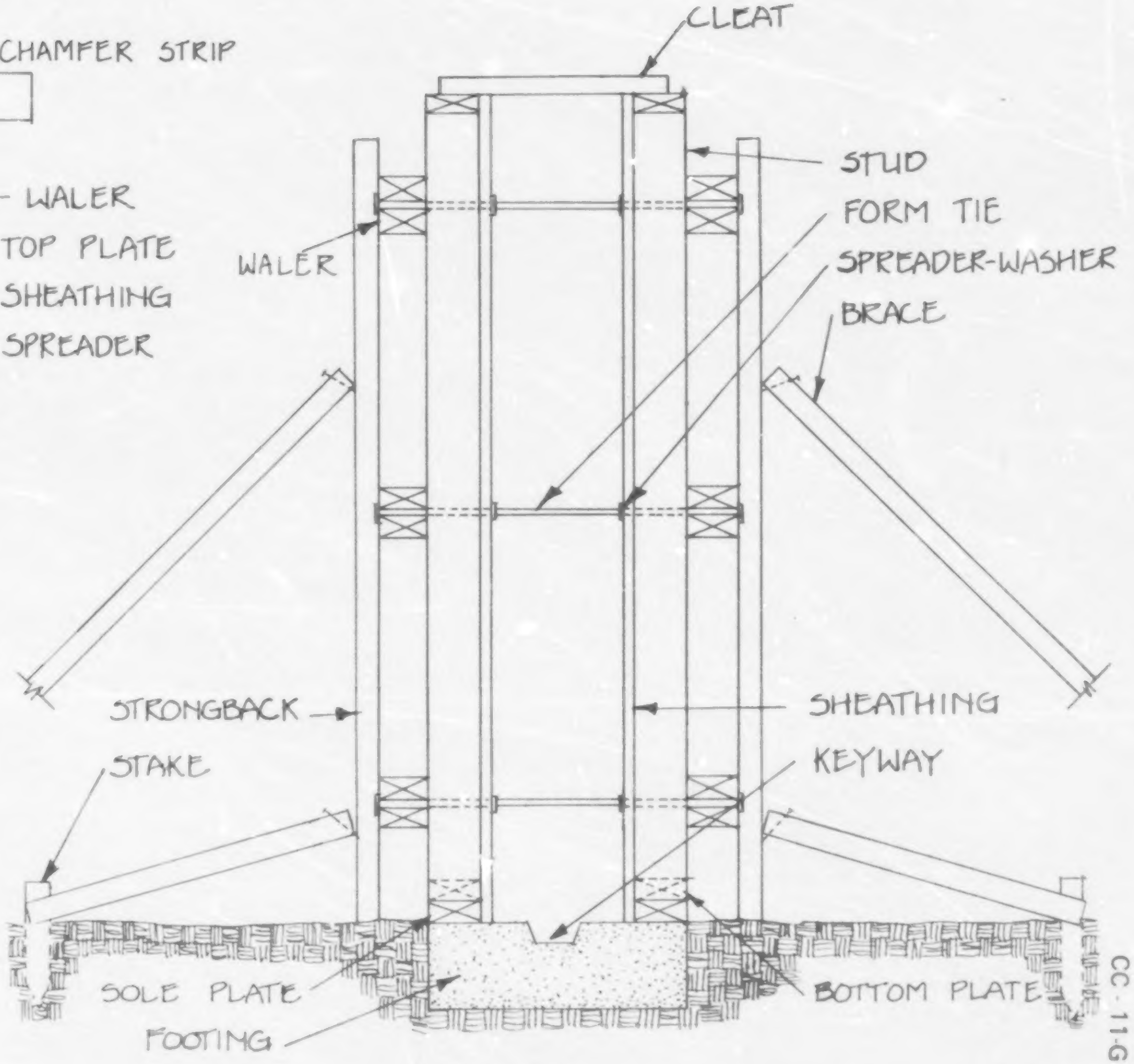
Slump Cone



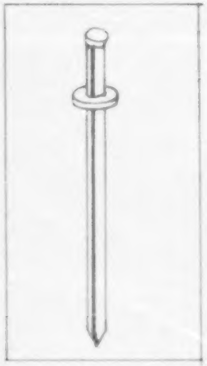
TM 1

Parts of a Form


BULKHEAD
CHAMFER STRIP
WALER
TOP PLATE
SHEATHING
SPREADER
KEY
RUSTICATION STRIP

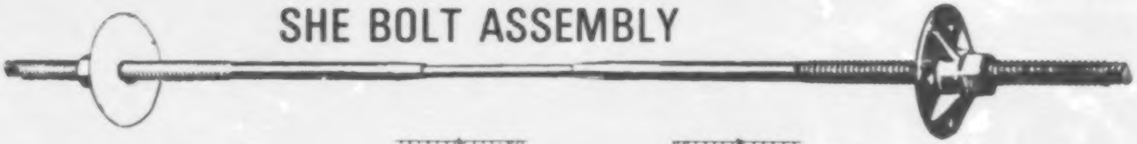

CLEAT
STUD
FORM TIE
SPREADER-WASHER
BRACE
WALER
STRONGBACK
SHEATHING
STAKE
KEYWAY
SOLE PLATE
FOOTING
BOTTOM PLATE

DUPLEX NAIL

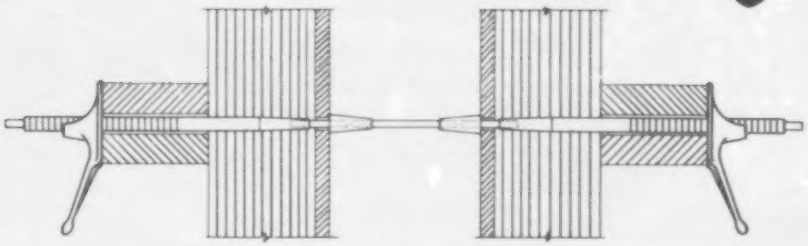


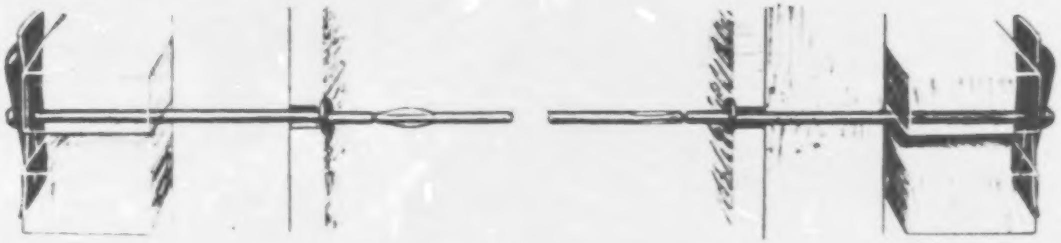
Form Ties

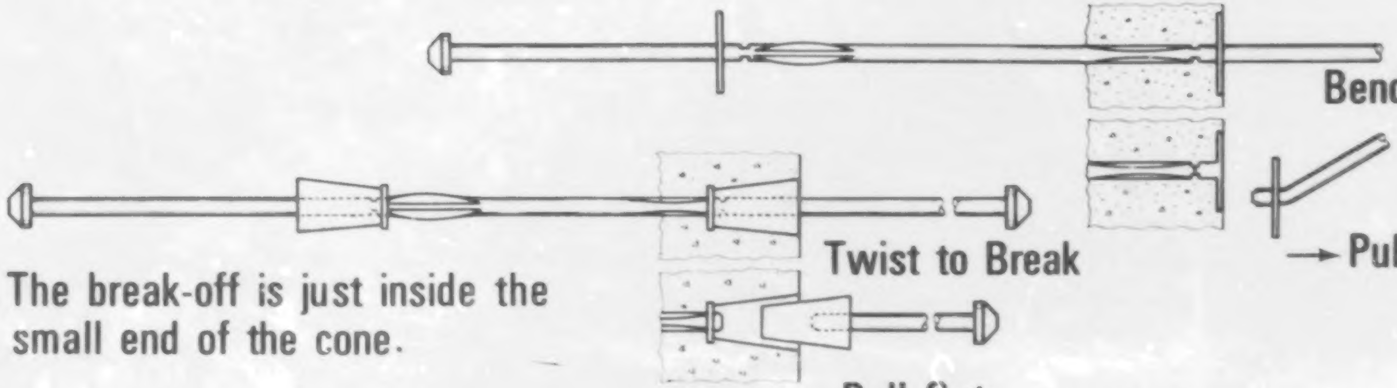
SHE BOLT ASSEMBLY



The Nut Washer Assembly consists of Two Outside Rods and Two Nut Washers







Bend Over End and Twist to Break

→ Pull Out

Twist to Break

→ Pull Out

The break-off is just inside the small end of the cone.

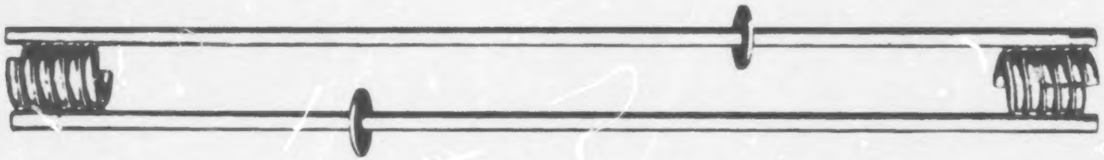
TM 3

CC-13-G

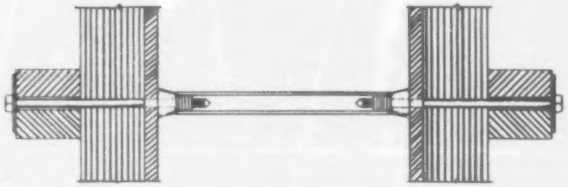
Form Ties

(CONTINUED)

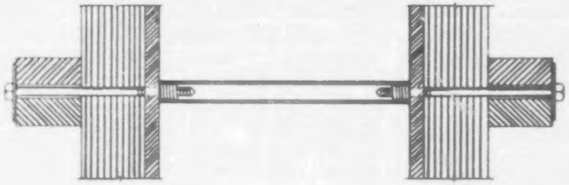
WATERSEAL COIL TIE



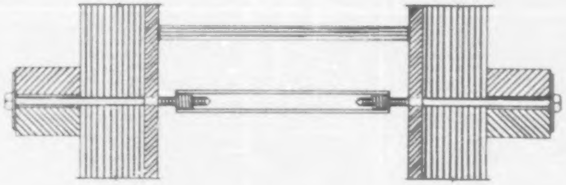
COIL TIE with SPREADER CONE



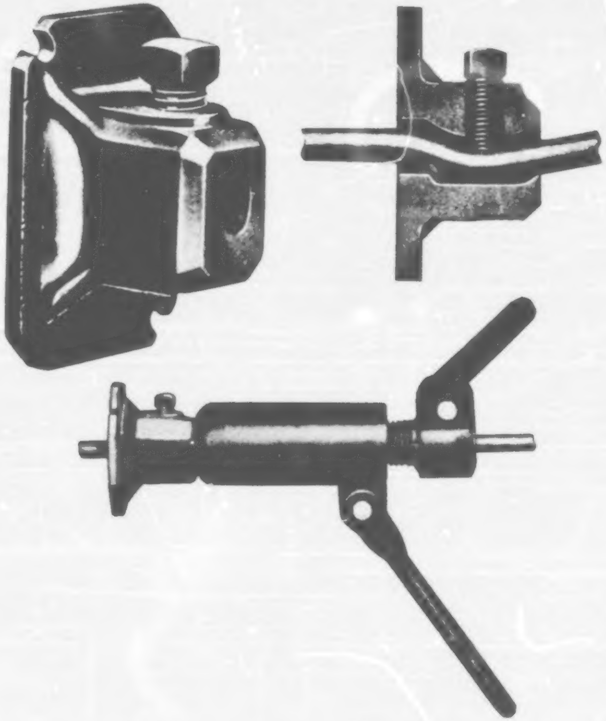
COIL TIE as SPREADER and TIE



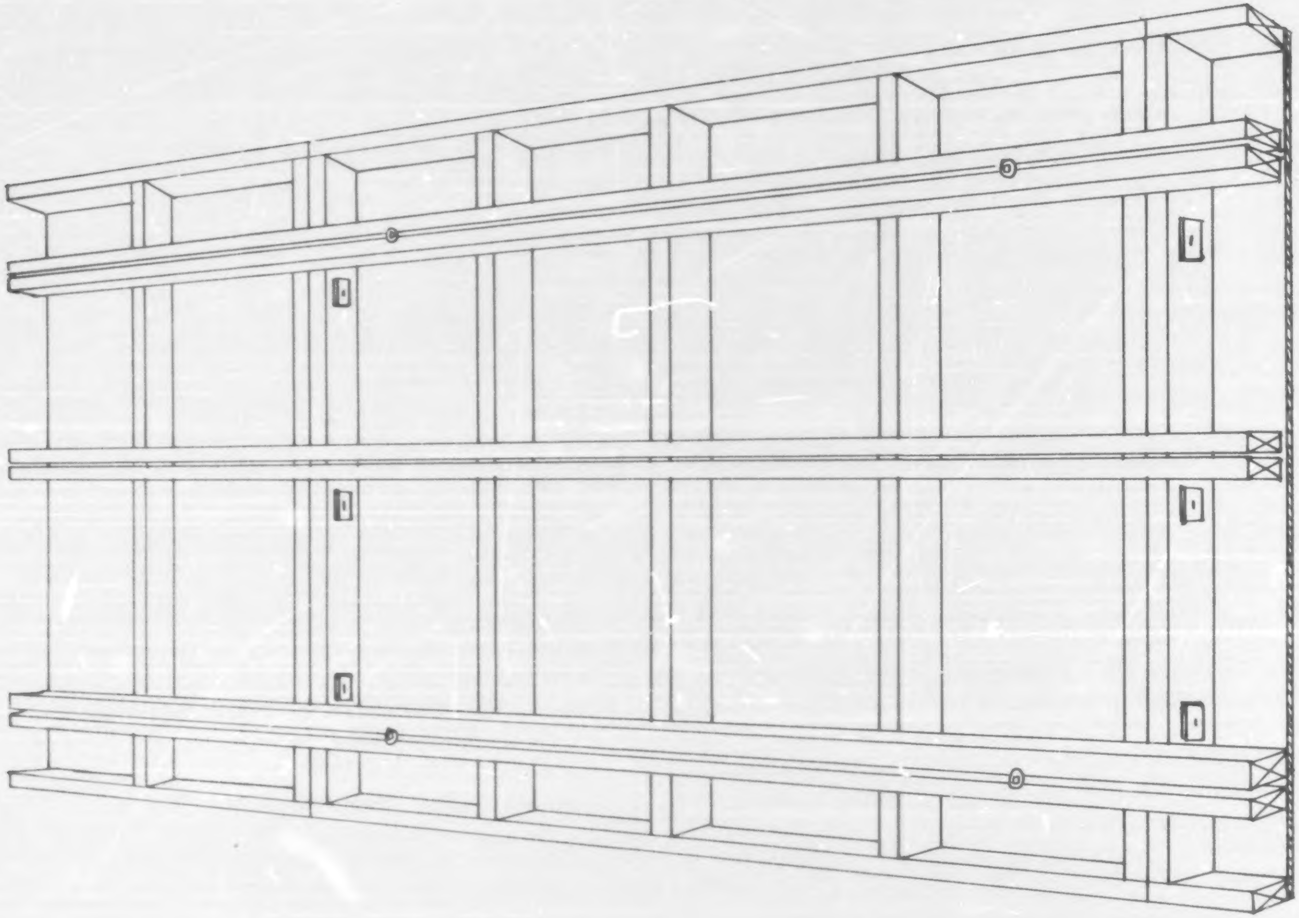
COIL TIE with SEPARATE SPREADER



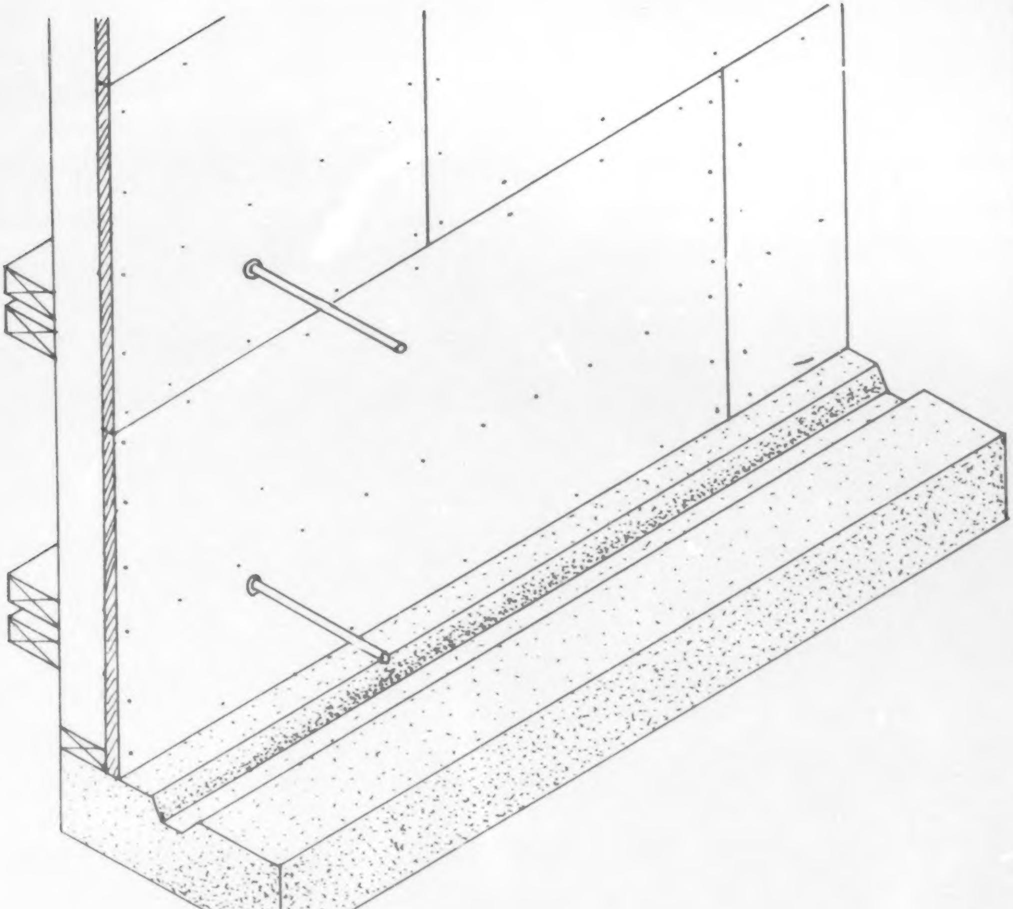
Form Clamps (Buttons) Used with Plain Round Mild Steel Rods



Panelized Forms

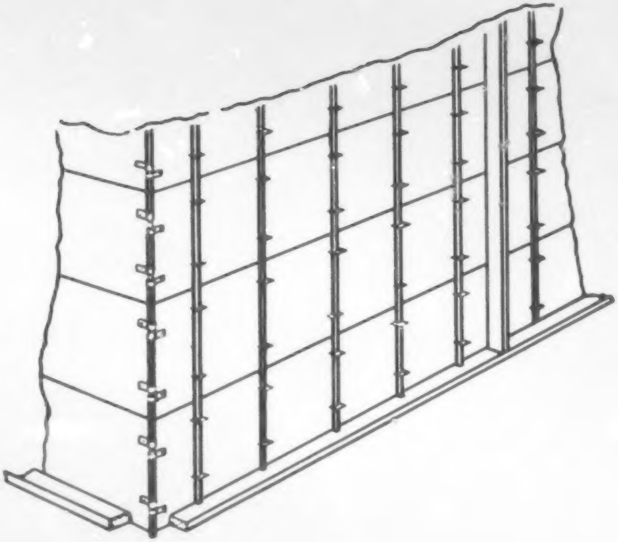


Built-in-Place Forms



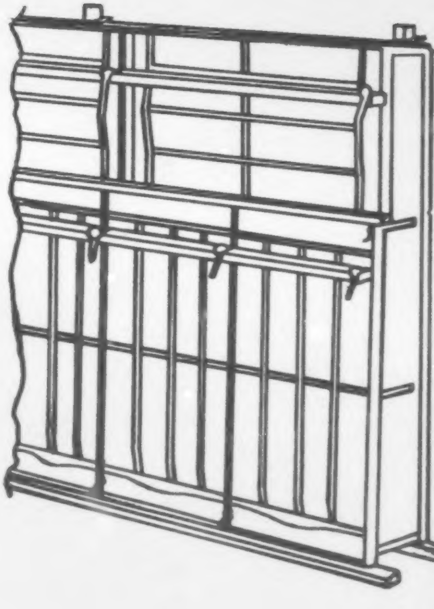
TM 6

Patented Forms



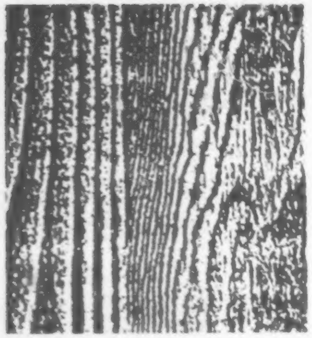
Wood

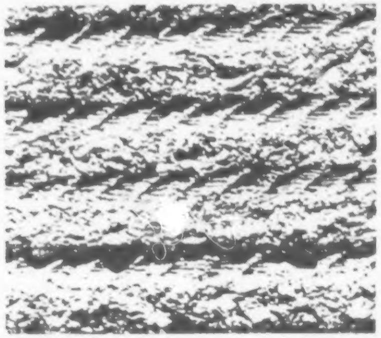
Metal

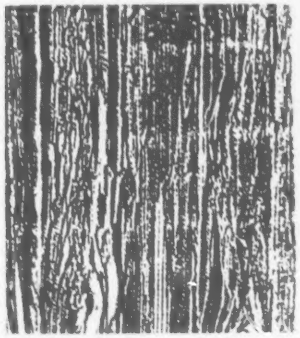


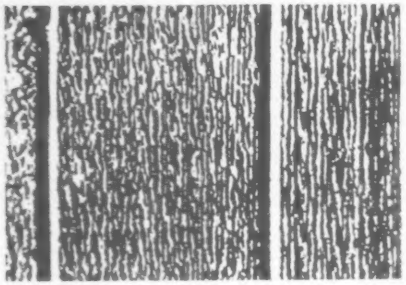
TM 7

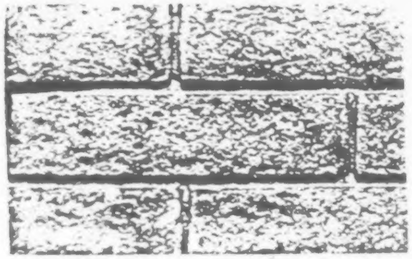
Manufactured Form Liners for Special Finish

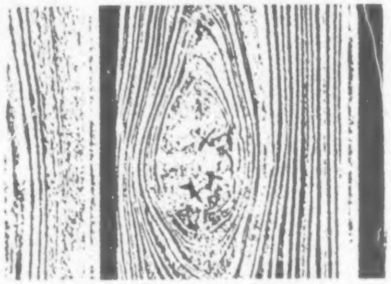


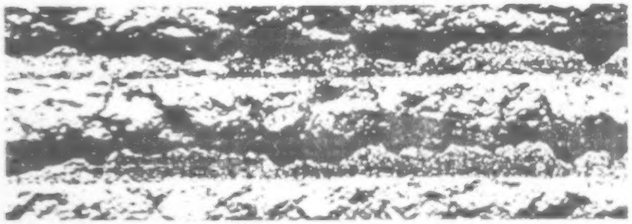


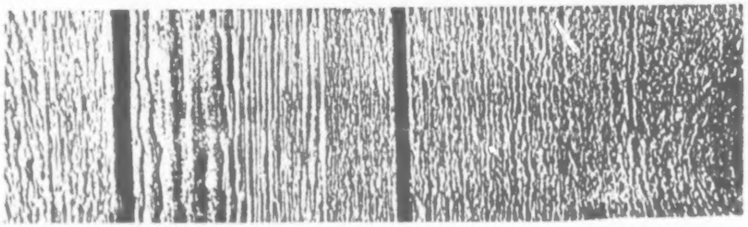












INTRODUCTION TO FORMING
UNIT I

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Wire or metal crosstie used to support pressure of wet concrete and maintain proper wall thickness

_____b. Beveled wood or metal strip placed on the form where future pours will occur

_____c. Block of wood or other material used as a spacer at offsets in a form

_____d. Wide boards, plywood, or metal that make up the face of the form

_____e. Short piece of steel bar inserted through a bulkhead to tie adjoining pours together

_____f. Piece of material nailed across a splice to hold it together and strengthen it

_____g. Board placed in a form to cut off the concrete pour

_____h. Small boards or steel bars sharpened on one end and driven into the ground to support a form

_____i. Block of wood that is used to hold the sides of the form apart and is removed as the concrete is poured; may also be an integral part of the form tie

_____j. Machine used to transport concrete from the mixer to the pour site

_____k. Power tool used to consolidate concrete

_____l. Level of finished concrete in a form

_____m. Receptacle, usually funnel-shaped, open, or with a gate at the bottom

_____n. Continuous mass of concrete cast as a single unit

1. Vibrator
2. Hopper
3. Power buggy
4. Bulkhead
5. Form tie
6. Dowel
7. Grade point
8. Key
9. Stakes
10. Monolithic pour
11. Scab
12. Sheathing
13. Spreader
14. Spacer block

______ o. That portion of a wall upon which the building rests

______ p. Groove left in concrete by removal of key

______ q. Paraffin oil or other manufactured product used on a form to prevent adhesion of concrete to the form

______ r. Double-headed nail used in forming and designed for easy removal

______ s. Piece of wood or other material that directs, resists, or supports weight or pressure

______ t. Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

______ u. Enlarged area at the base of a wall or another object used to distribute the weight of the superstructure

______ v. Steel bars used to strengthen concrete walls or beams

______ w. Rubber, neoprene, copper, or some composition material used to prevent passage of water through a joint

15. Key way
16. Foundation
17. Footing
18. Cleat
19. Brace
20. Duplex nail
21. Form oil
22. Water stop
23. Reinforcing bars (rebars)

2. Write the purpose of forms.

____

____

3. Match the external factors that affect form design on the right to their effects. Place the appropriate numbers in the blanks provided.

______ a. Greater the slump, the longer it takes concrete to set; therefore, the pressure remains on the forms for a longer period of time

______ b. Affects the rate at which hydration (set) of concrete occurs; the higher the temperature, the faster concrete sets

______ c. Feet of concrete depth poured in one hour

______ d. Will not be exposed in the finished areas of the structure, so some deflection and leakage is permissable

1. Structural concrete
2. Rate of pour
3. Temperature
4. Slump

______e. Concrete weighs 150 pounds per cubic foot; the impact of this weight on concrete already placed causes an increase in pressure on the forms; the greater the height of the drop and the mass of concrete, the greater the pressure increase

______f. Thickness and length of the wall are used to figure the rate of pour; height and width have no bearing on pressure on forms, except for the method of placement

______g. Power vibration can cause pressure to increase 35%

______h. Will be exposed in the finished areas of the structure; forms will be designed to give a minimum of deflection and leakage; the concrete surface may be smooth, rough, incised, sculptured, sandblasted, bushhammered, or many other finishes

5. Architectural concrete
6. Size of form
7. Method of placement
8. Vibration

4. Identify the parts of a form. Write the parts in the blanks next to the corresponding numbers.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

g. ____________________

h. ____________________

i. ____________________

j. ____________________

k. ____________________

l. ____________________

m. ____________________

n. ____________________

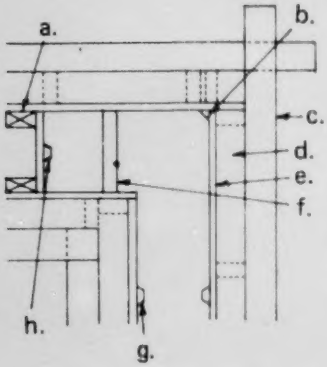
o. ____________________

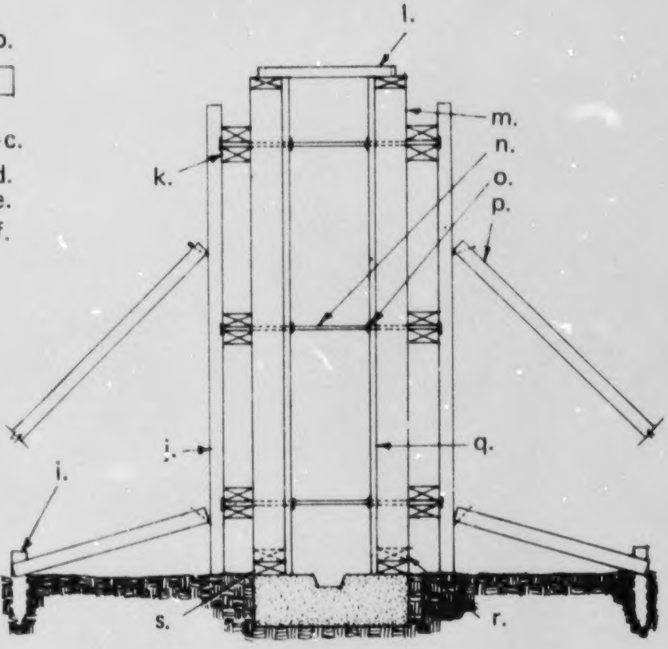
p. ____________________

q. ____________________

r. ____________________

s. ____________________




l.
m.
n.
k.
o.
p.
j.
q.
i.
s.
r.

5. Identify the types of forms below. Place the correct numbers in the blanks provided. A blank may have more than one correct answer.

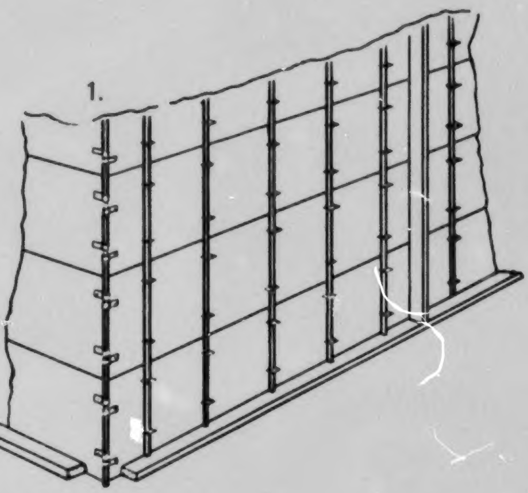
_____a. Panelized

_____b. Built-in-place

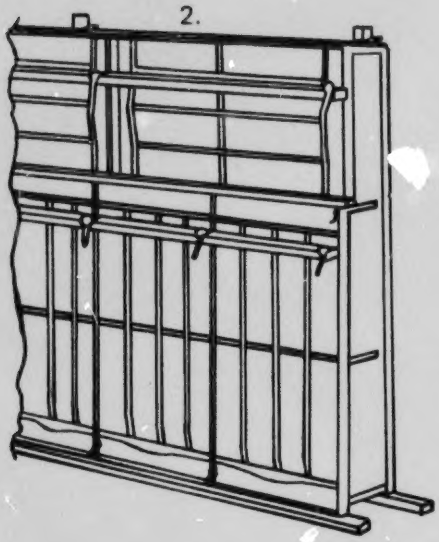
_____c. Patented

_____d. Manufactured forms with predesigned finishes

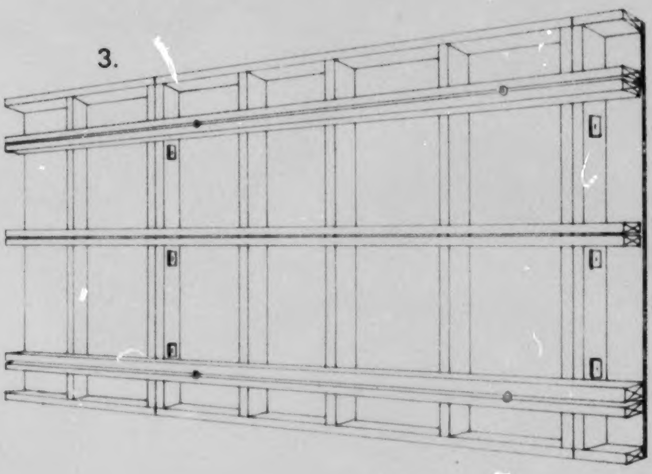
1.



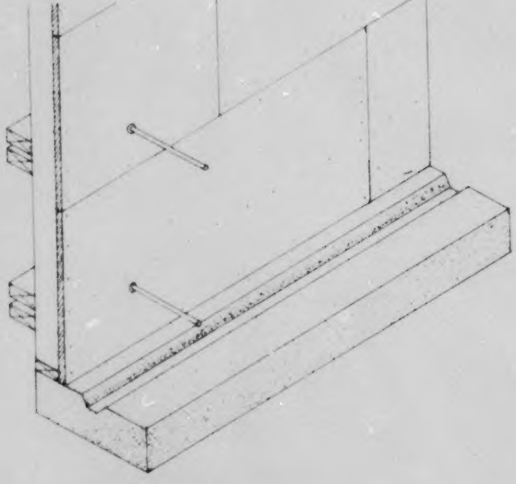
2.



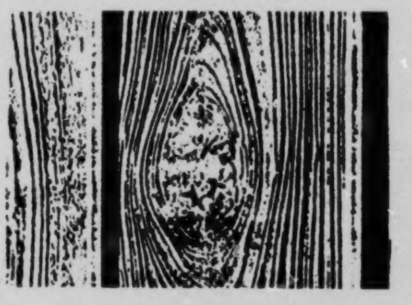
3.



4.



5.



INTRODUCTION TO FORMING
UNIT I

ANSWERS TO TEST

1. a. 5
   b. 8
   c. 14
   d. 12
   e. 6
   f. 11
   g. 4
   h. 9
   i. 13
   j. 3
   k. 1
   l. 7
   m. 2
   n. 10
   o. 16
   p. 15
   q. 21
   r. 20
   s. 19
   t. 18
   u. 17
   v. 23
   w. 22

2. To hold the wet concrete to the desired shape until it has set

3. a. 4
   b. 3
   c. 2
   d. 1
   e. 7
   f. 6
   g. 8
   h. 5

4. a. Bulkhead
   b. Chamfer strip
   c. Waler
   d. Top plate
   e. Sheathing
   f. Spreader
   g. Rustication strip
   h. Key

i. Stake

j. Strongback

k. Waler

l. Cleat

m. Stud

n. Form tie

o. Spreader-washer

p. Brace

q. Sheathing

r. Bottom plate

s. Sole plate

5. a. 3

b. 4

c. 1, 2

d. 5

FOOTING FORMS
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify types of footings, construct three types of footing forms, and strip a pier footing form. This knowledge will be evidenced by completion of job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with footing forms to the correct definitions.
2. Write the purpose of forms.
3. Identify the parts of a form.
4. Identify types of footings.
5. Name methods of form construction.
6. Demonstrate the ability to:
    a. Construct and set forms for a continuous footing.
    b. Construct and set forms for a pile cap.
    c. Construct and set forms for a pier footing.
    d. Strip pier footing forms and prepare for erection at another location.

FOOTING FORMS
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Parts of a Form
      2. TM 2--Continuous Footing
      3. TM 3--Pile Cap
      4. TM 4--Pier Footings
      5. TM 5--Grade Beam
      6. TM 6--Grillage Footing
      7. TM 7--Stepped Continuous Footing
      8. TM 8--Built-on-Site Forms
      9. TM 9--Patented Forms

   D. Job sheets

      1. Job Sheet #1--Construct and Set Forms for a Continuous Footing
      2. Job Sheet #2--Construct and Set Forms for a Pile Cap

3. Job Sheet #3--Construct and Set Forms for a Pier Footing
4. Job Sheet #4--Strip Pier Footing Forms and Prepare for Erection at Another Location

E. Test

F. Answers to test

III. Unit references:

A. Waugh, Herbert R., and Burbank, Nelson L. *Building Terms and Definitions.* New York: Simmons-Boardman Publishing Corporation.

B. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Cliffs: Prentice-Hall Inc., 1970.

C. Peurifoy, R. L. *Framework for Concrete Structures.* New York: McGraw-Hill Book Company, 1964.

D. *Concrete Form Construction.* Albany, New York: Delmar Publishers.

E. Hendrix, Laborn J. "Bud," and Patton, Bob. *Construction Craftsman's Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1978.

FOOTING FORMS
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure

B. Cleat--Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

C. Duplex nail--Double-headed nail used in forming and designed for easy removal

D. Footing--Enlarged area at the base of a wall or another object used to distribute the weight of the superstructure

E. Form tie--Wire or metal crosstie used to hold the pressure of wet concrete and maintain the proper wall thickness

F. Foundation--That portion of a wall upon which the structure rests

G. Grade point--Level of the finished concrete in a form

H. Key--Beveled strip of wood or metal placed on the form where future pours occur

I. Key way--Groove left in the concrete by removal of the key

J. Monolithic pour--Continuous mass of concrete cast as a single unit

K. Scab--Piece of material nailed across a splice to strengthen and hold it together

L. Sheathing--Wide boards, plywood, or metal that make up the face of the form

M. Spreader--Block of wood that is used to hold the sides of the form apart; is removed as the concrete is poured; may also be an integral part of the form tie

N. Spacer block--Block of wood or other material used as a spacer at offsets in a form

O. Stakes--Small boards or steel bars sharpened on one end and driven into the ground to support a form

P. Dowel--Short piece of steel bar inserted through a bulkhead to tie adjoining pours together

Q. Bulkhead--Board placed in a form to cut off the concrete pour

INFORMATION SHEET

R. Form oil--Paraffin oil or other manufactured product used on a form to prevent adhesion of concrete to the form

S. Boil board--Wide board placed around the bottom of a form to keep the concrete from rising up around the form

T. Strip form--Process of removing a form after the concrete has set

U. Power buggy--Machine used to transport concrete from the mixer to the pour site

V. Vibrator--Power tool used to consolidate concrete

W. Hopper--Receptacle, usually funnel-shaped, open, or with a gate at the bottom

X. Height of instrument (HI)--Vertical distance from the bench mark to the line of sight of the instrument

Y. Property line--Boundaries of a lot or plot of ground

Z. Kerf--Sawed line in which to fit string line to hold it in place

AA. Pilaster--Upright architectural member treated as a column; usually projects a third or less of its width from the wall

BB. Waler--Horizontal brace used in form construction

CC. Wedge--Tapered piece of wood or metal

II. Purpose of forms--To hold wet concrete to the desired shape until it has set

III. Parts of a form (Transparency 1)

A. Sheathing

B. Brace

C. Stake

D. Spreader

E. Cleat

F. Form tie

G. Waler

H. Stud

I. Sole plate

INFORMATION SHEET

   J. Bottom plate

   K. Top plate

   L. Scab

   M. Bulkhead

IV. Types of footings (Transparencies 2, 3, 4, 5, 6, and 7)

   A. Continuous

   B. Pile cap

   C. Pier

   D. Grade beam

   E. Grillage

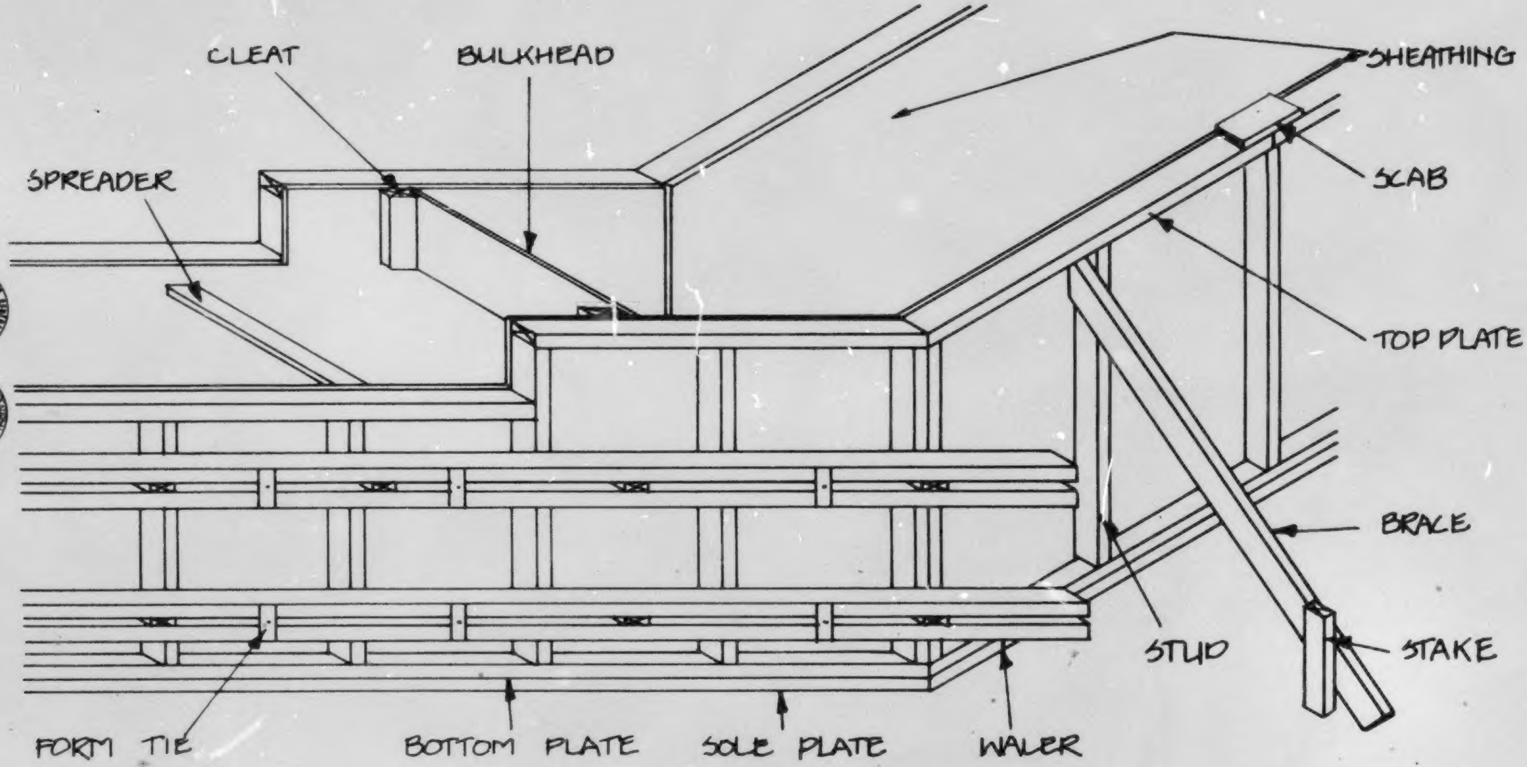
   F. Stepped (continuous)

V. Methods of form construction (Transparencies 8 and 9)

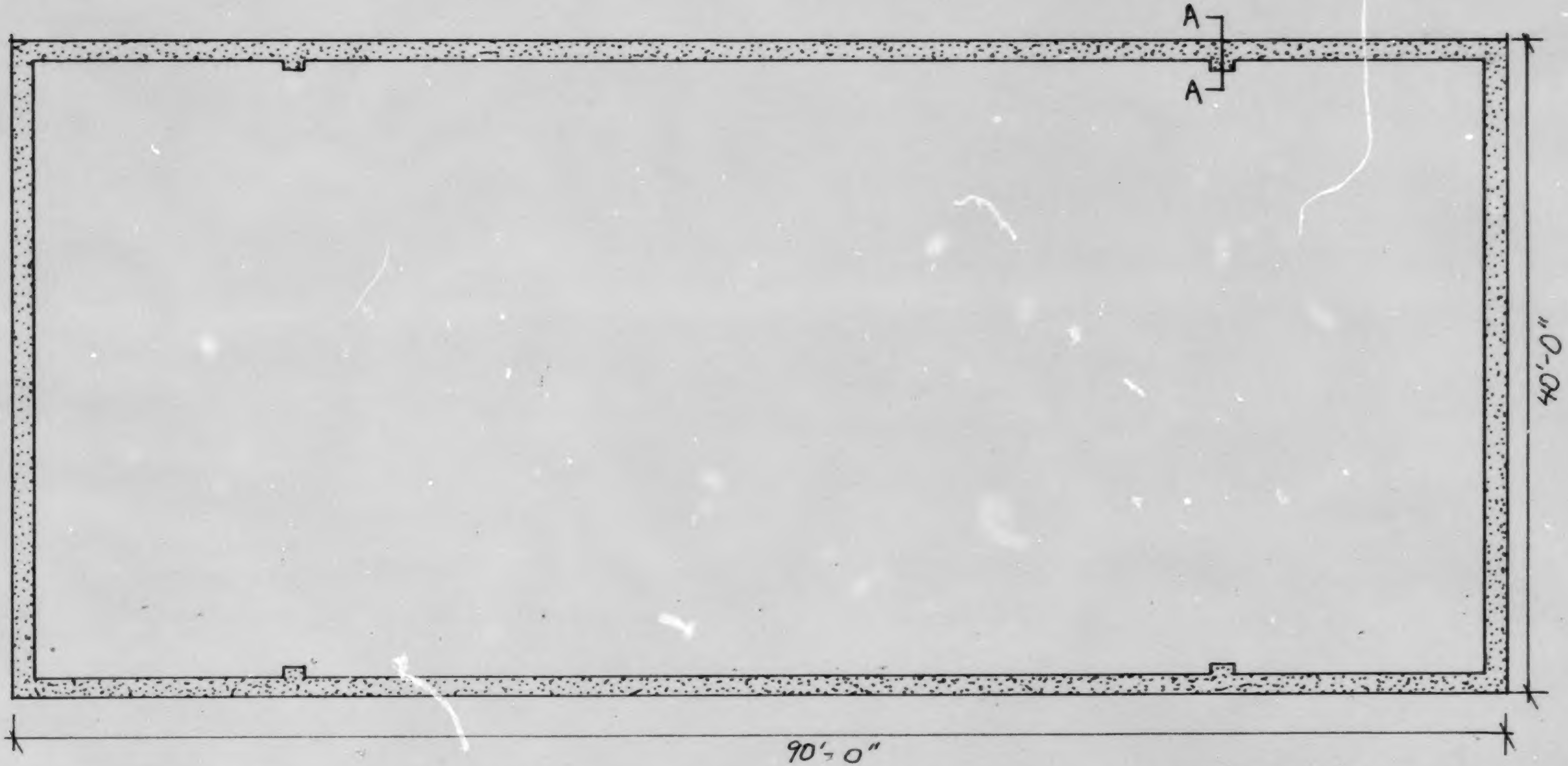
   A. Built-on-site

   B. Patented

Parts of a Form

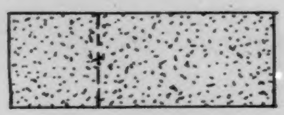

CLEAT
BULKHEAD
SHEATHING
SPREADER
SCAB
TOP PLATE
BRACE
STUD
STAKE
FORM TIE
BOTTOM PLATE
SOLE PLATE
WALER

Continuous Footing

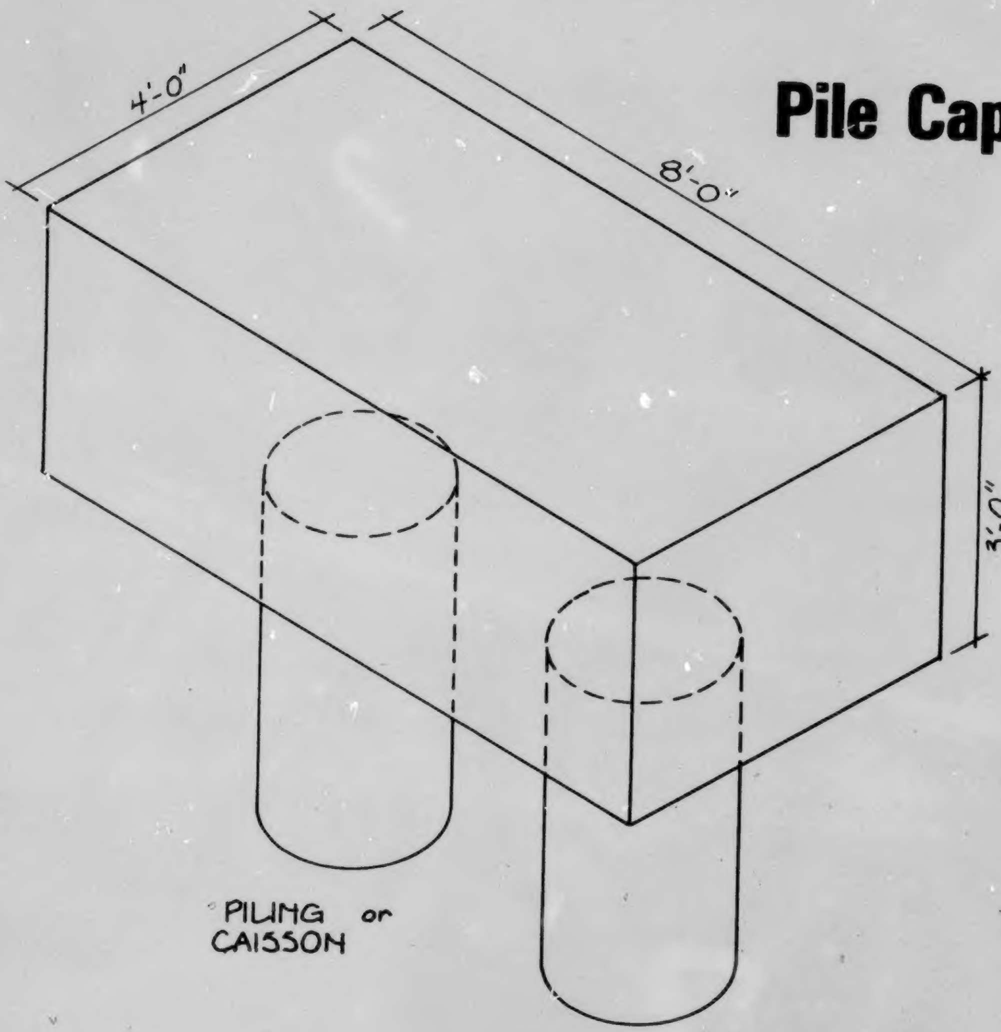


SCALE: 1" = 10'-0"

SECTION A-A
SCALE: 1" = 1'-0"

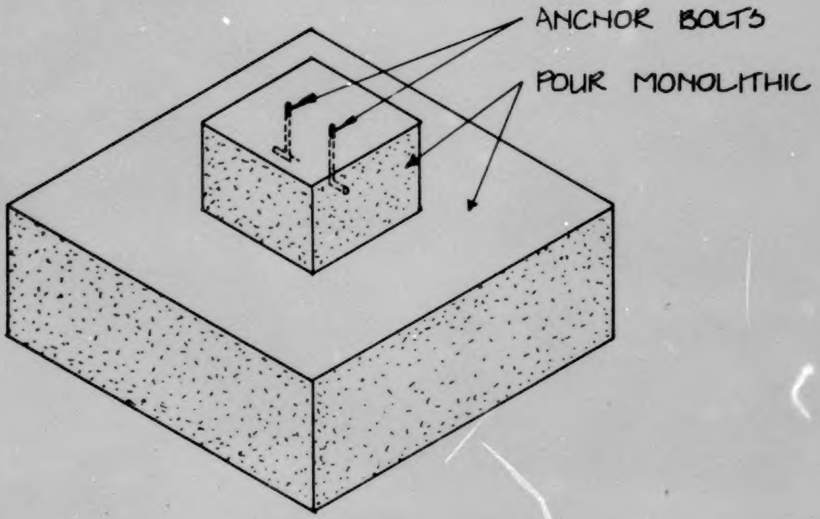


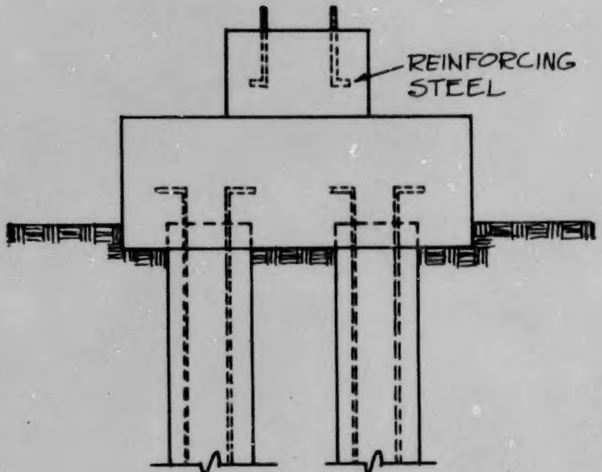
Pile Cap


4'-0"
8'-0"
3'-0"
PILING or CAISSON

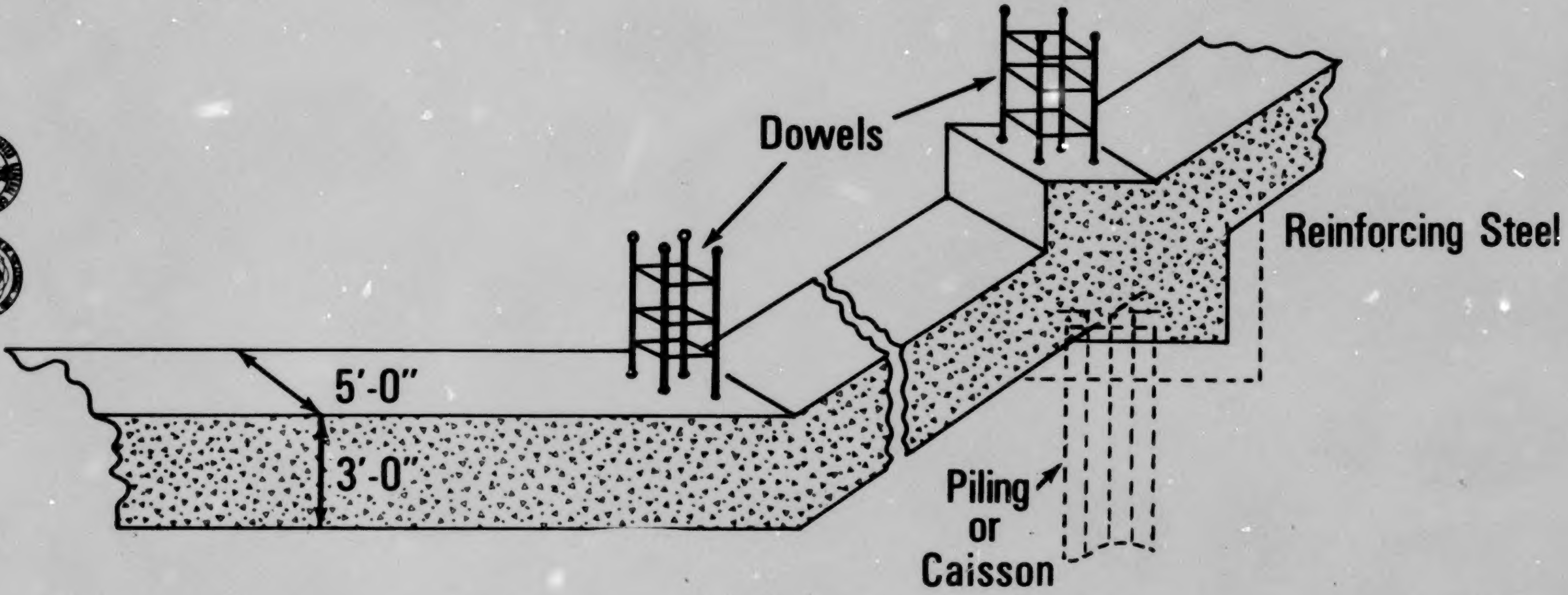
SCALE: 1/2" = 1'-0"

Pier Footings


ANCHOR BOLTS
POUR MONOLITHIC


REINFORCING STEEL

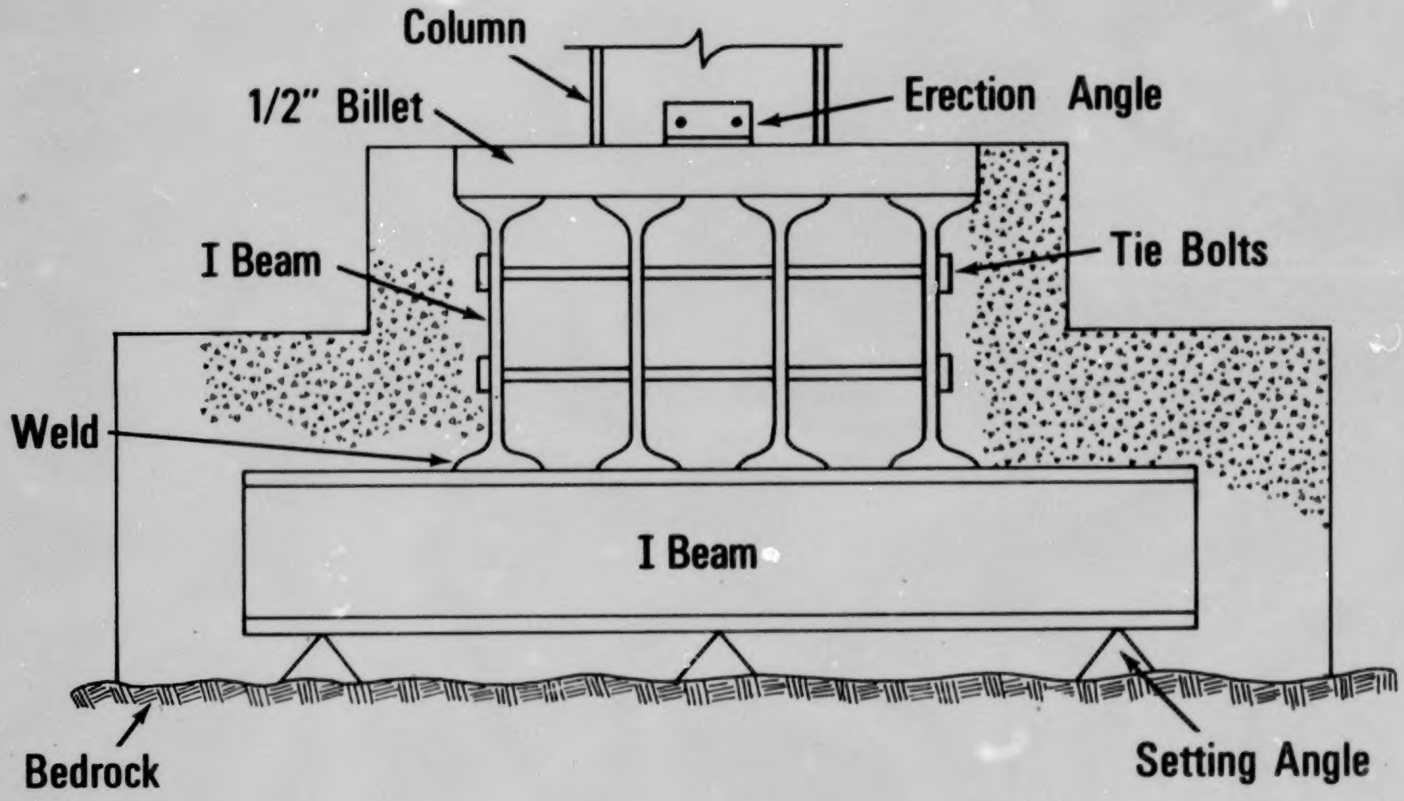
Grade Beam


Dowels
Reinforcing Steel
5'-0"
3'-0"
Piling or Caisson

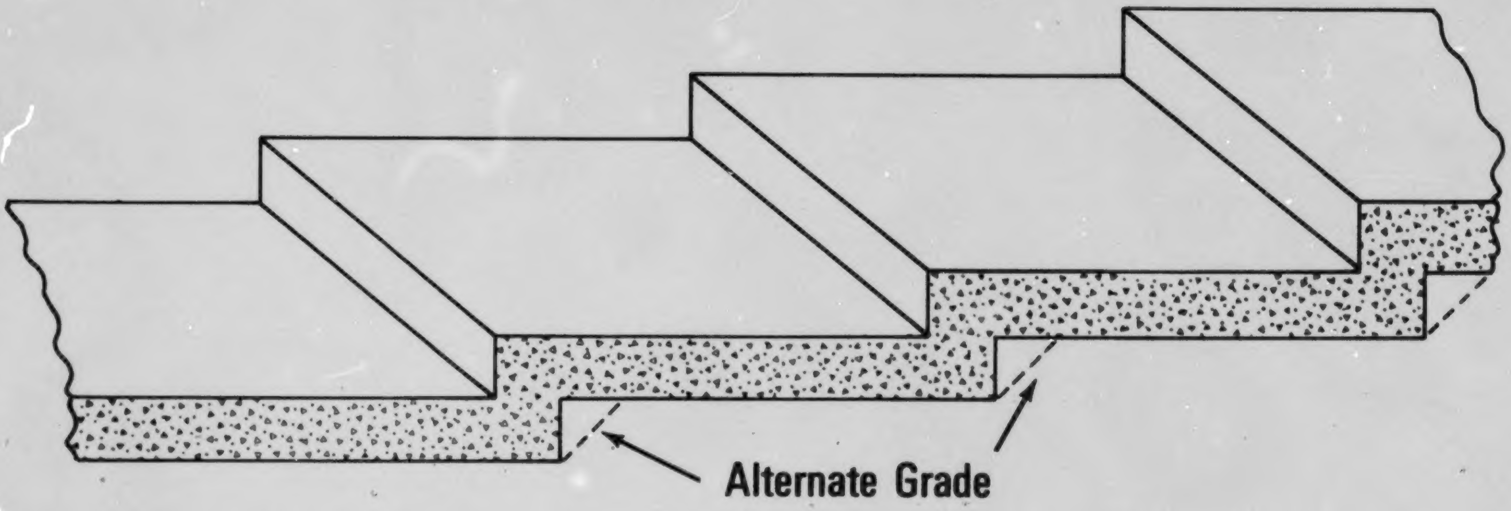
872

873

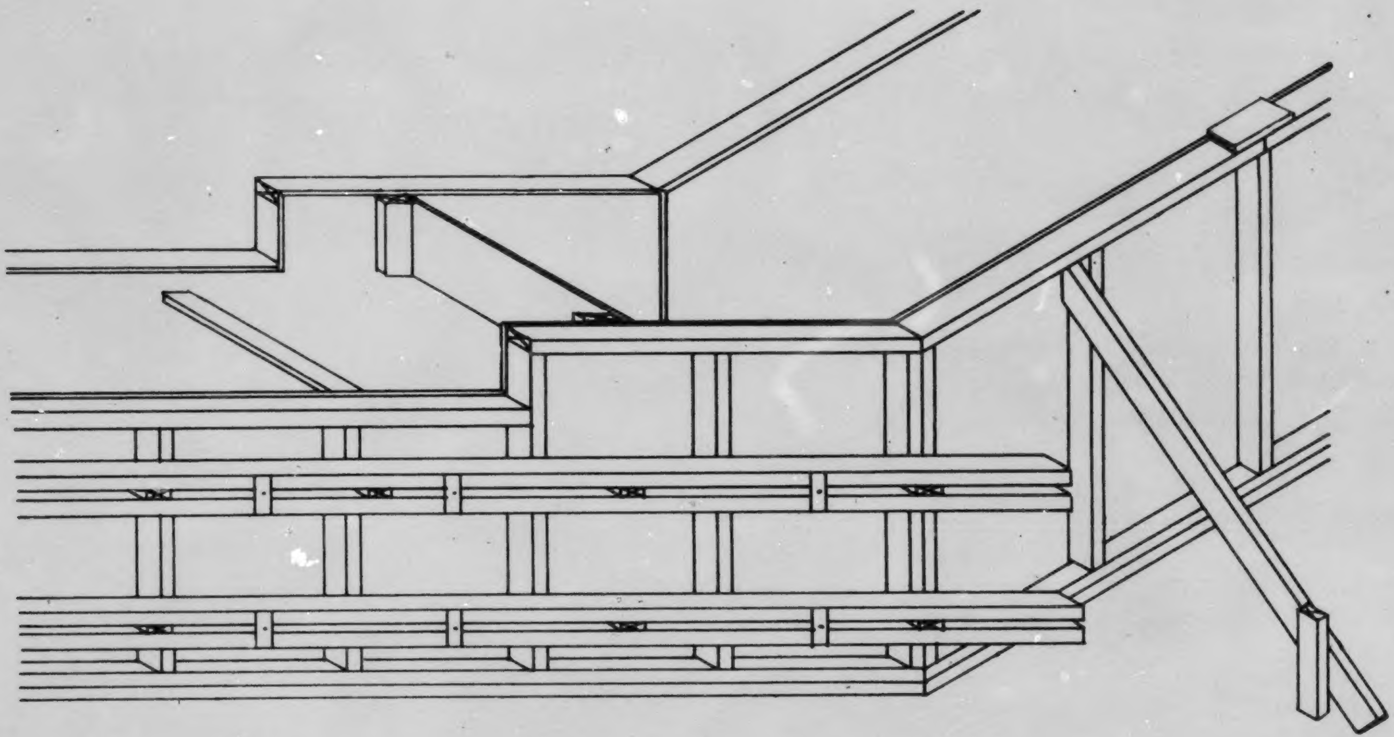
Grillage Footing


Column
1/2" Billet
Erection Angle
I Beam
Tie Bolts
Weld
I Beam
Bedrock
Setting Angle

Stepped Continuous Footing


Alternate Grade

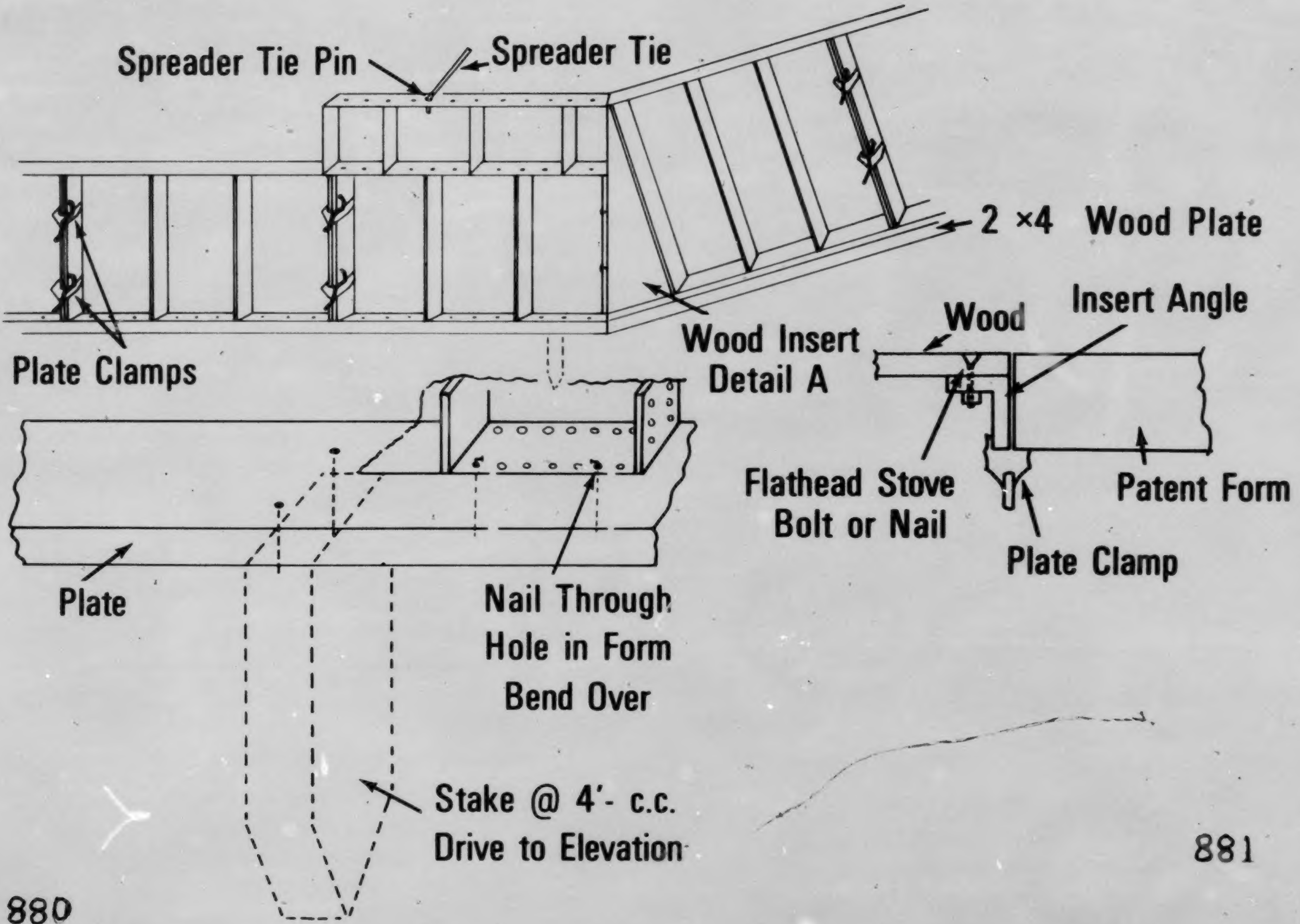
Built-on-Site Forms



878

879

Patented Forms


Spreader Tie Pin
Spreader Tie
2 ×4 Wood Plate
Insert Angle
Wood
Wood Insert
Detail A
Plate Clamps
Flathead Stove
Bolt or Nail
Patent Form
Plate Clamp
Plate
Nail Through
Hole in Form
Bend Over
Stake @ 4′- c.c.
Drive to Elevation

FOOTING FORMS
UNIT II

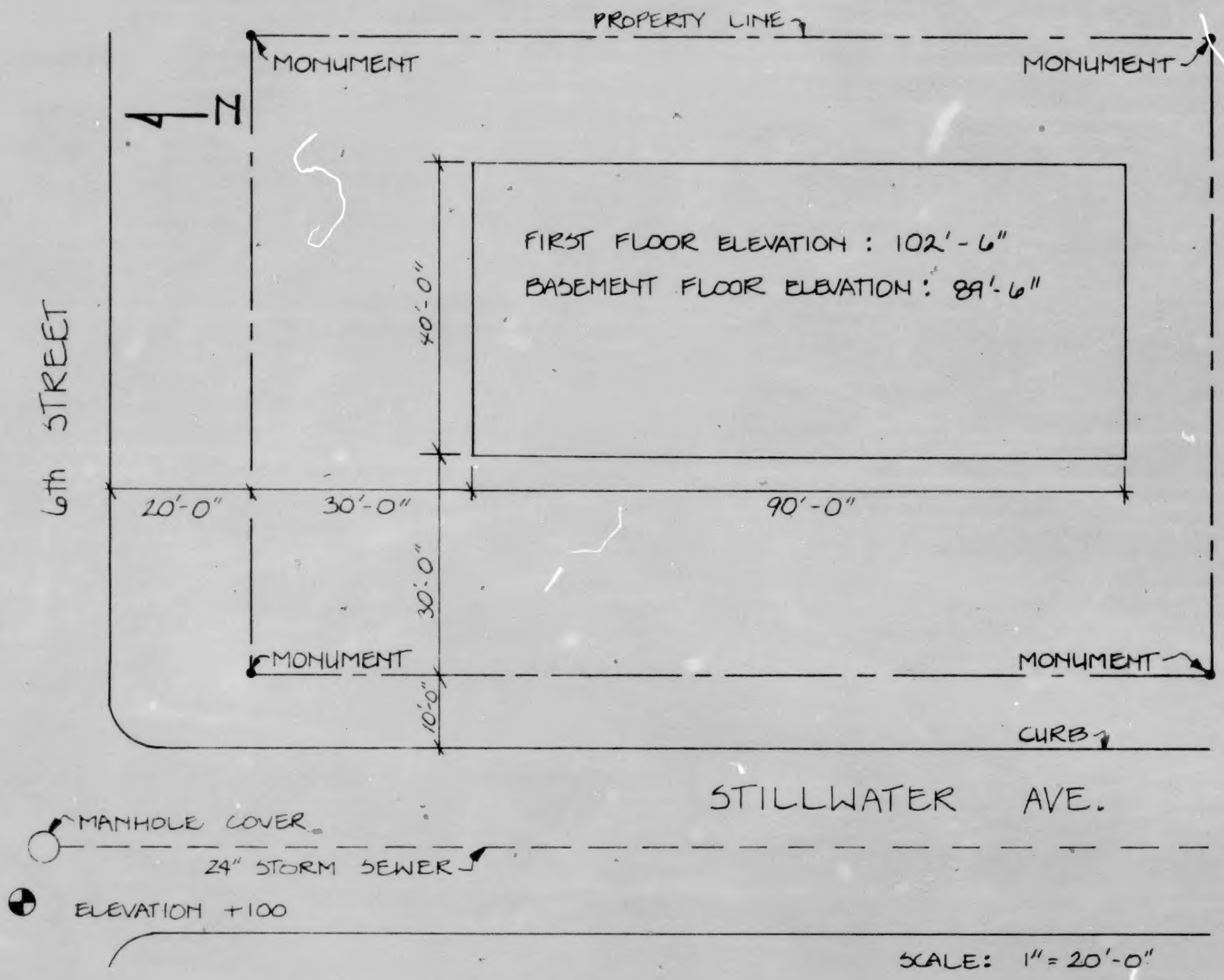
JOB SHEET #1--CONSTRUCT AND SET FORMS FOR A CONTINUOUS FOOTING

I. Tools, materials, and plans

- A. Tools
  1. Eectric handsaw
  2. Crosscut handsaw
  3. Claw hammer, 16 ounce or larger
  4. Sledge hammer
  5. Tape measure, 100 foot
  6. Tape measure, 12 or 16 foot
  7. Level, hand
  8. String line
  9. Builder's level
  10. Transit
  11. Plumb bob
- B. Materials
  1. Stakes
  2. Sheathing boards
  3. Spreaders
  4. Duplex nails, 8d and 16d
  5. Form oil
- C. Plans

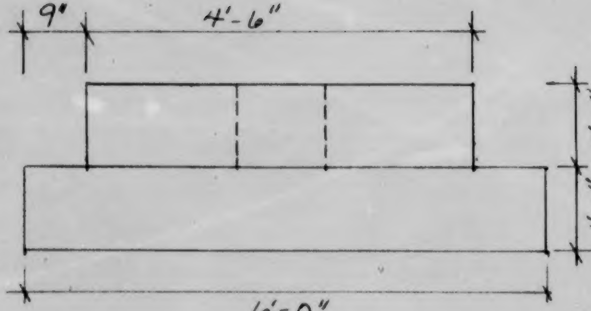
  (NOTE: The following plans are shown on the next three pages.)

  1. Plot Plan Sheet #1
  2. Foundation Plan Sheet #2
  3. Batter Board Layout Plan Sheet #3

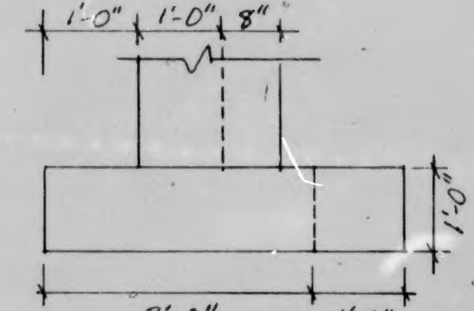

PROPERTY LINE
MONUMENT
MONUMENT
N
6th STREET
FIRST FLOOR ELEVATION : 102'-6"
BASEMENT FLOOR ELEVATION : 89'-6"
40'-0"
20'-0"
30'-0"
90'-0"
30'-0"
MONUMENT
MONUMENT
10'-0"
CURB
STILLWATER AVE.
MANHOLE COVER
24" STORM SEWER
ELEVATION +100
SCALE: 1" = 20'-0"

PLOT PLAN SHEET #1

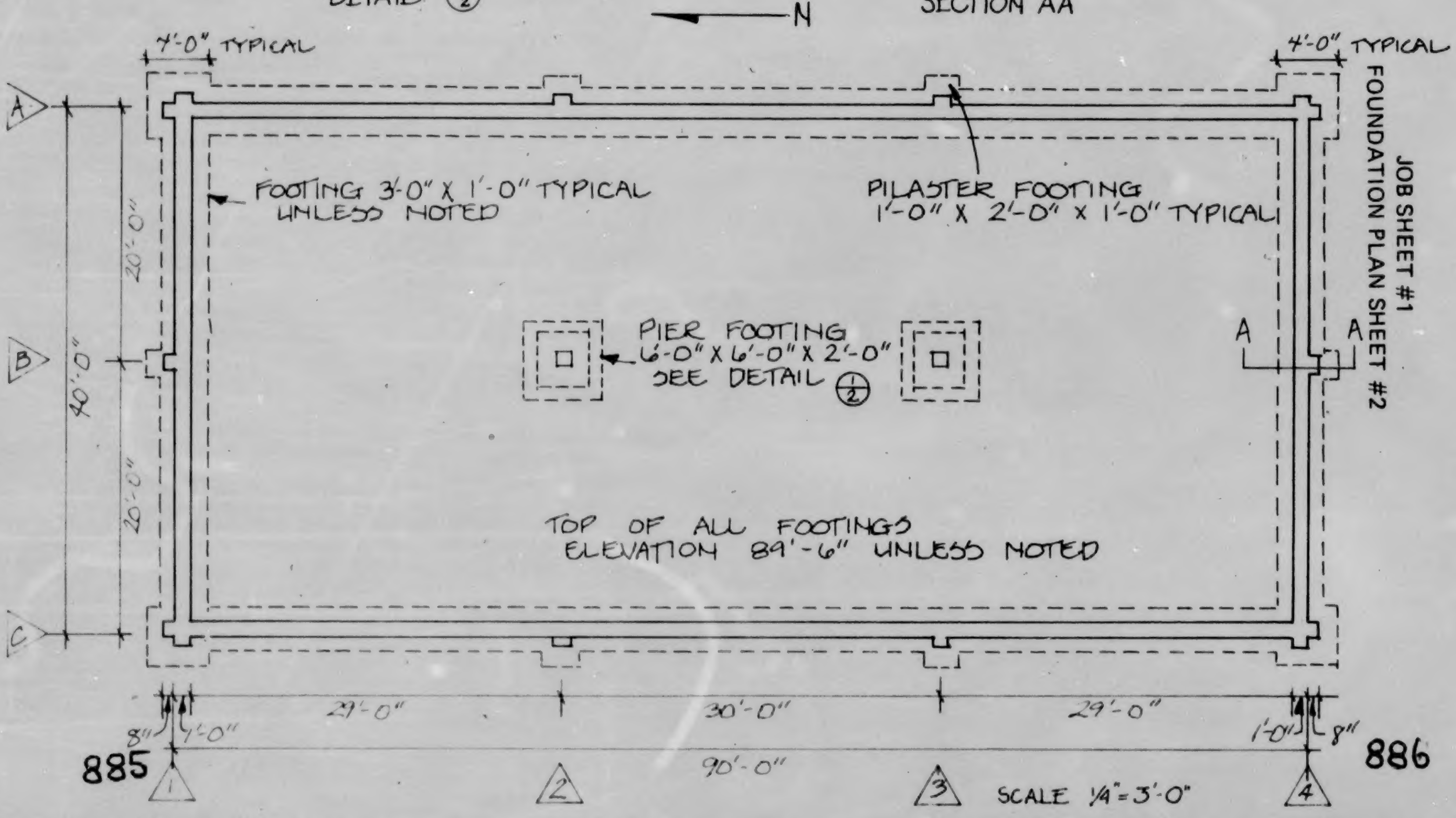
JOB SHEET #1



DETAIL ½


1'-0"
1'-0"
8"
1'-0"
3'-0"
1'-0"

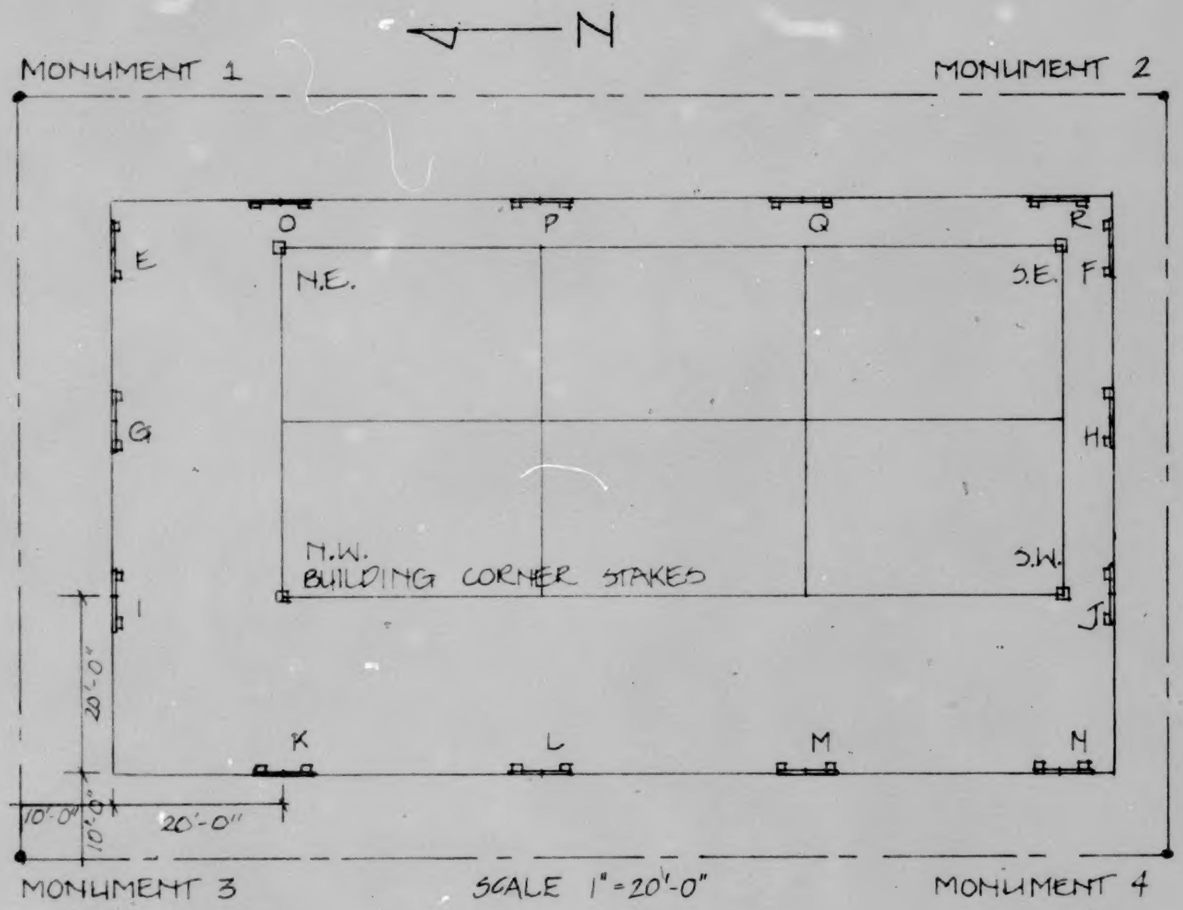
SECTION AA


N
4'-0" TYPICAL
4'-0" TYPICAL
A
B
C
20'-0"
20'-0"
40'-0"
FOOTING 3'-0" X 1'-0" TYPICAL UNLESS NOTED
PILASTER FOOTING 1'-0" X 2'-0" X 1'-0" TYPICAL
PIER FOOTING 6'-0" X 6'-0" X 2'-0" SEE DETAIL ½
A
A
TOP OF ALL FOOTINGS ELEVATION 89'-6" UNLESS NOTED
8"
1'-0"
29'-0"
30'-0"
29'-0"
1'-0"
8"
90'-0"
1
2
3
4
SCALE 1/4"=3'-0"

JOB SHEET #1
FOUNDATION PLAN SHEET #2

JOB SHEET #1

BATTER BOARD LAYOUT PLAN SHEET #3


N
MONUMENT 1
MONUMENT 2
MONUMENT 3
MONUMENT 4
O
P
Q
R
E
F
G
H
I
J
K
L
M
N
N.E.
S.E.
N.W.
S.W.
BUILDING CORNER STAKES
20'-0"
10'-0"
10'-0"
20'-0"
SCALE 1" = 20'-0"

JOB SHEET #1

II. Procedure

A. Locate the markings on the batter boards that indicate the building lines; secure the string in the kerfs and pull the lines taut (Figure 1)

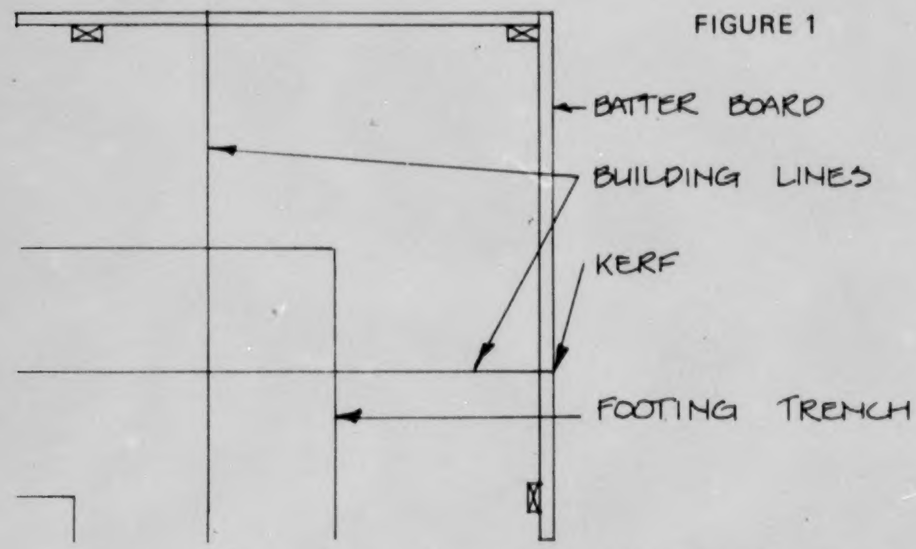
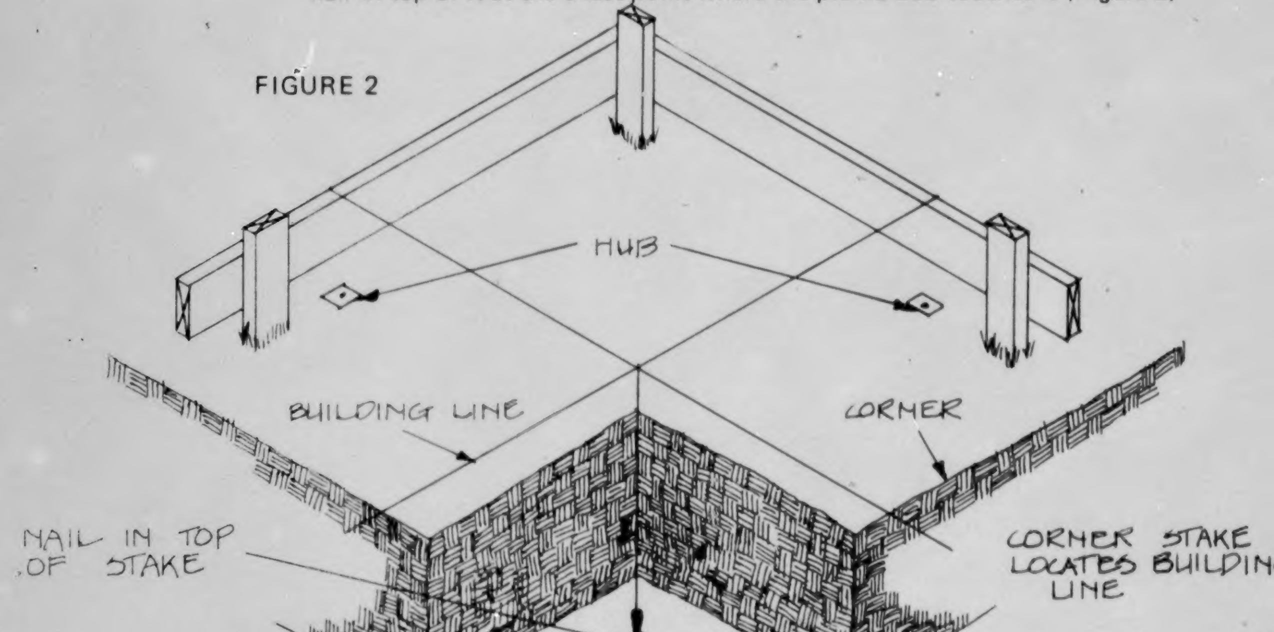


FIGURE 1

BATTER BOARD
BUILDING LINES
KERF
FOOTING TRENCH

B. Drop a plumb bob from the intersection of the two lines to point A to locate the building corner; drive a corner stake at this location and drive a nail in top of it at the exact point where the plumb bob touches it (Figure 2)

FIGURE 2


HUB
BUILDING LINE
CORNER
NAIL IN TOP OF STAKE
CORNER STAKE LOCATES BUILDIN LINE
POINT A

JOB SHEET #1

C. Transfer bench mark to bottom of excavation

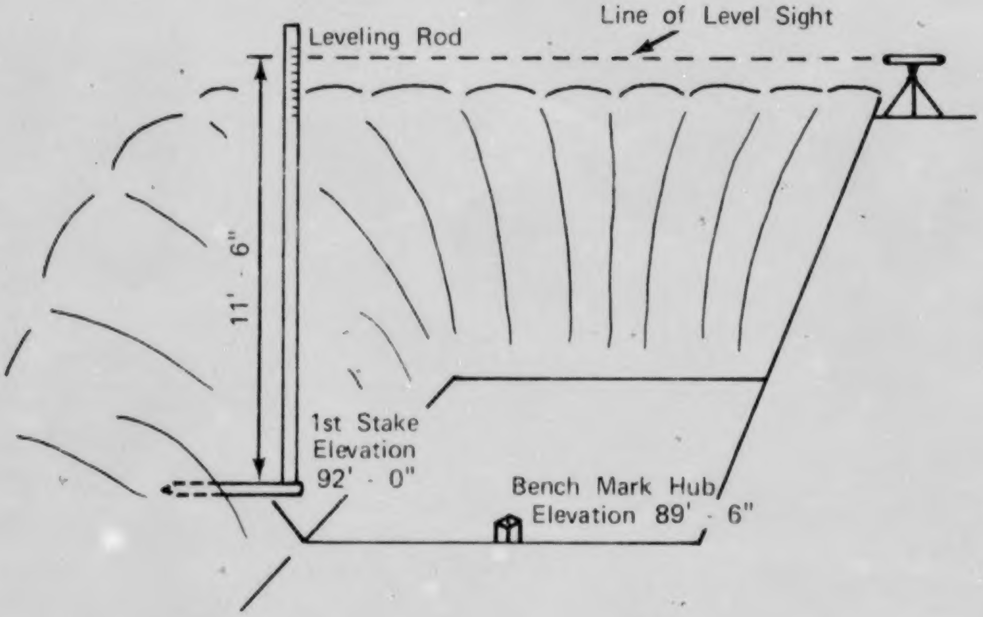
1. Set up builder's level

2. Establish HI from bench mark

   (NOTE: See Plot Plan Sheet #1.)

3. Assume an HI of 103'-6"; from the plot plan the basement floor elevation is 89'-6" from 103'-6" which is 14'-0"; this is the figure to read on the leveling rod; however, the rod is only 12' long, so drive a stake in the bank reading 11'-6" on the leveling rod; this will be at elevation 92'-0" (Figure 3)

FIGURE 3


Leveling Rod
Line of Level Sight
11' - 6"
1st Stake
Elevation
92' - 0"
Bench Mark Hub
Elevation 89' - 6"

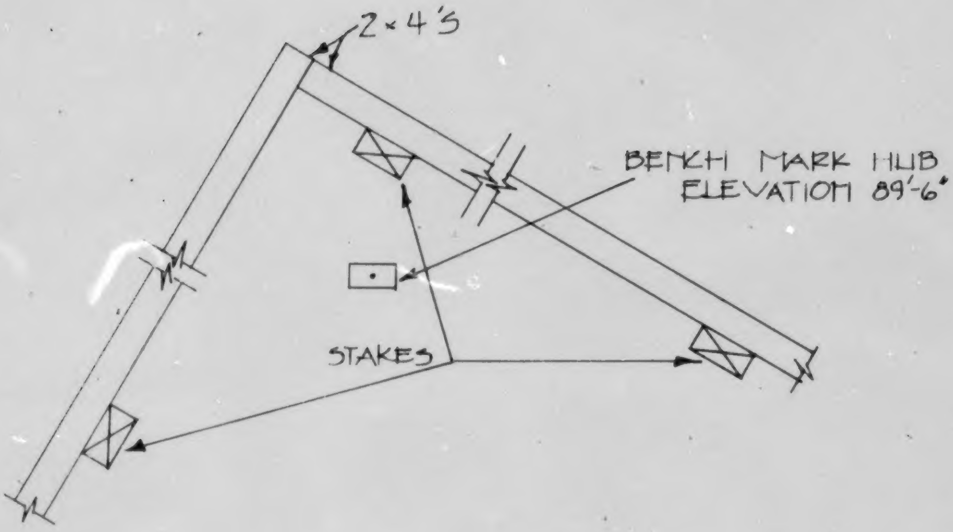
4. Move the instrument to the bottom of the excavation and set it up

JOB SHEET #1

5. Pick up HI from stake at elevation 92'-0" and set another hub inside the footing line with the top of the stake at elevation 89'-6" (Figure 4)

   (NOTE: The bench mark hub should be placed in a central location and out of the areas of traffic.)

FIGURE 4


2 × 4'S
BENCH MARK HUB
ELEVATION 89'-6"
STAKES

SCALE: 1"=1'-0"

D. Repeat step B at all corners

JOB SHEET #1

E. Measure from the building corner stakes to the inside of the footing plus the thickness of the sheathing board; locate and drive the corner form stakes; leave the top of the stakes one to two inches above the grade point (Figure 5)

(NOTE: See foundation plan. This dimension should be 24" plus 1 1/2" for sheathing which equals 25 1/2".)

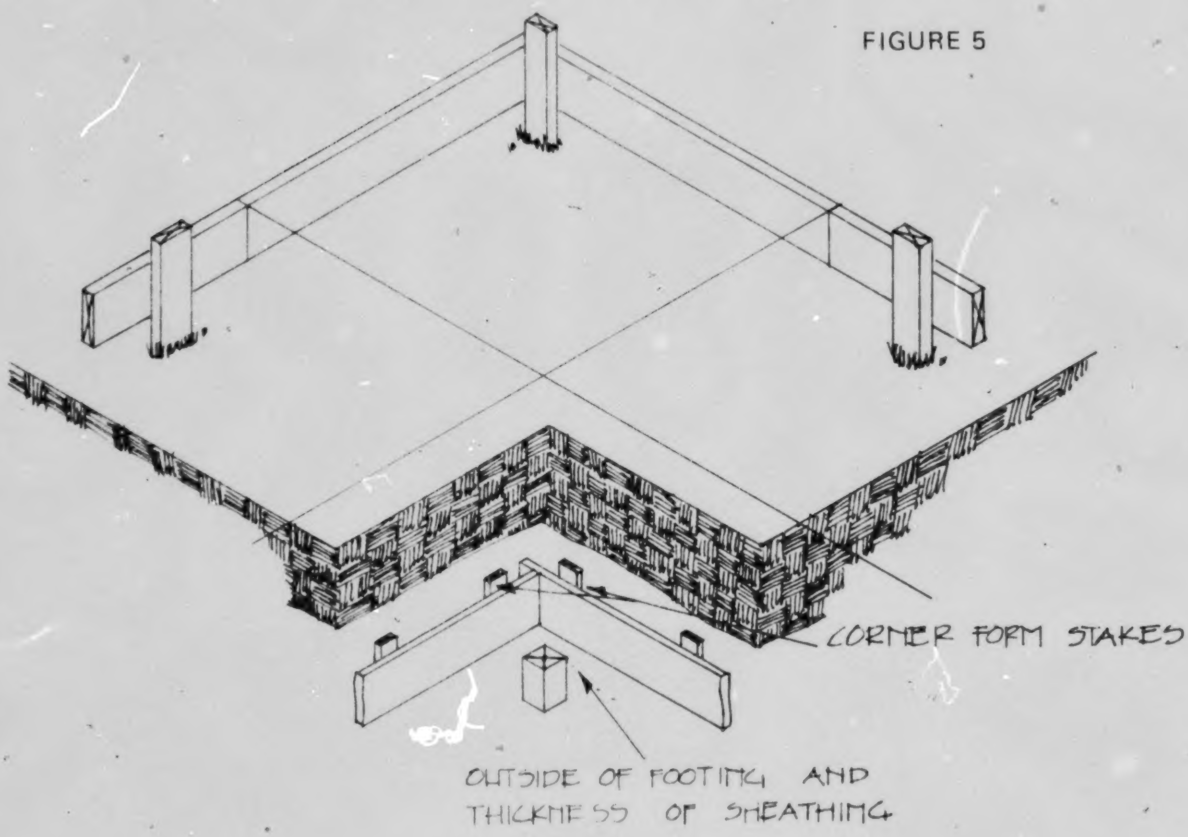


FIGURE 5

(NOTE: Use the builder's level to locate the grade point. See Figure 3.)

F. Stretch a string between the corner stakes one inch above the grade point

G. Drive intermediate stakes at about four-foot intervals

H. Place sheathing boards in position and nail them to the stake one inch below the string

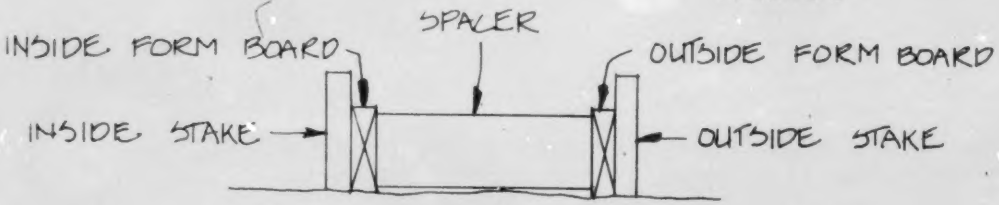
(NOTE: Form oil must be applied before installation.)

JOB SHEET #1

I. Cut a spreader the width of the footing to locate the position for the outside stakes

(NOTE: Remember to allow for the thickness of the sheathing when locating stakes. See Figure 6.)

FIGURE 6


SPACER
INSIDE FORM BOARD
OUTSIDE FORM BOARD
INSIDE STAKE
OUTSIDE STAKE

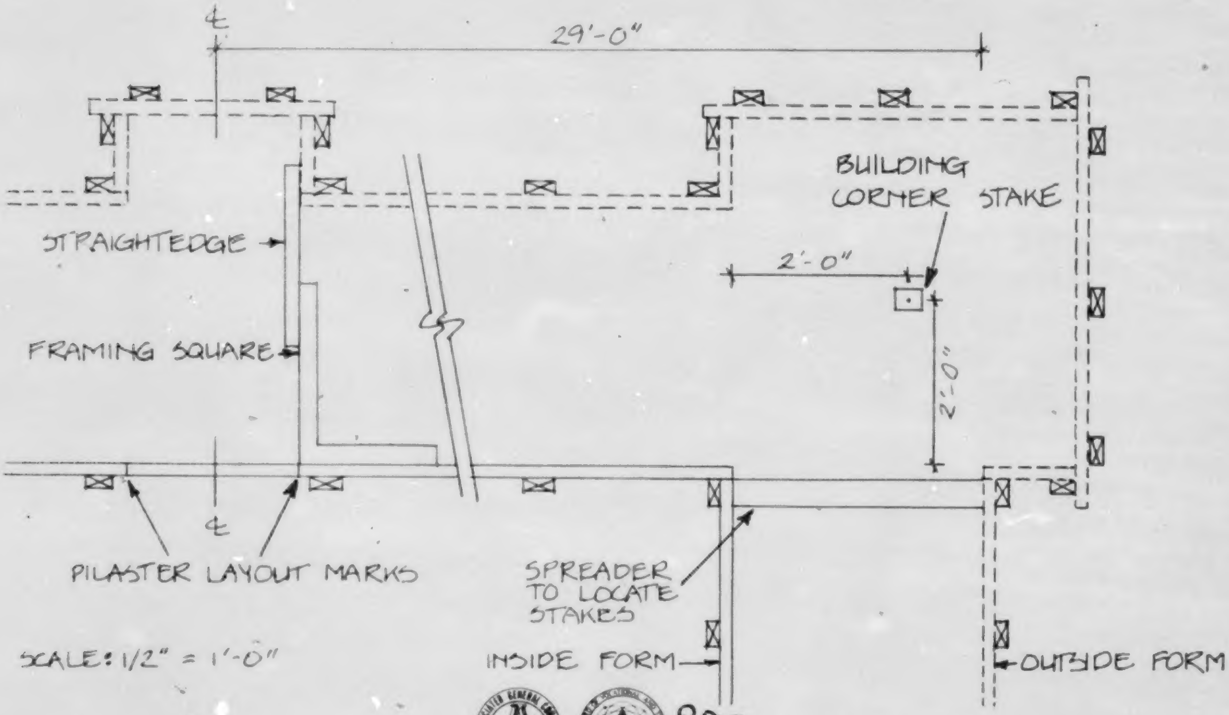
J. Lay out all pilaster footings on inside form

(NOTE: See foundation plan for dimensions.)

K. Drive stakes as indicated in Figure 7 and attach outside sheathing boards to the stakes

(NOTE: Level across the top of the sheathing boards to locate the grade point for the outside form.)

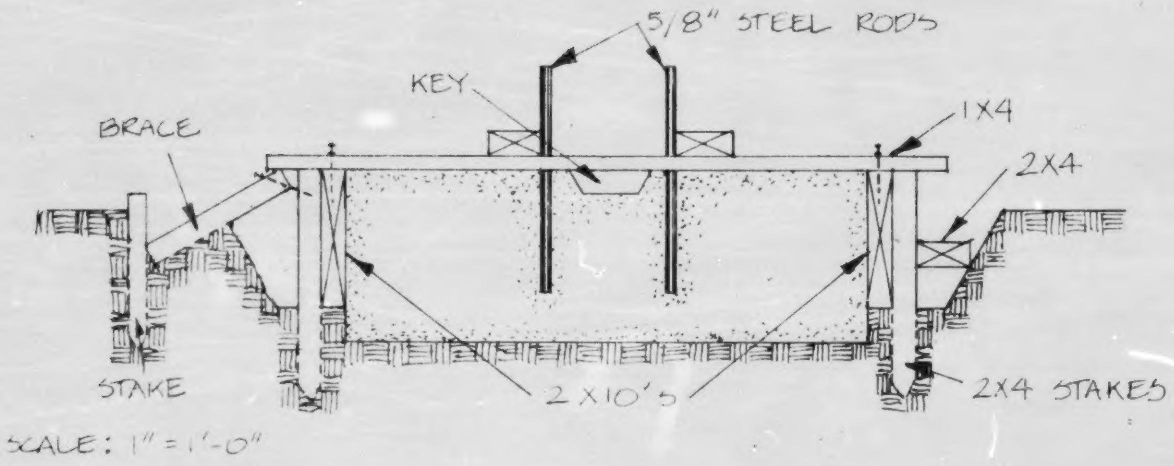
FIGURE 7


℄
29'-0"
BUILDING CORNER STAKE
STRAIGHTEDGE
2'-0"
FRAMING SQUARE
2'-0"
℄
PILASTER LAYOUT MARKS
SPREADER TO LOCATE STAKES
SCALE: 1/2" = 1'-0"
INSIDE FORM
OUTSIDE FORM

JOB SHEET #1

L. Nail cleats across top of form (Figure 8)

FIGURE 8


5/8" STEEL RODS
KEY
1X4
BRACE
2X4
STAKE
2 X10'S
2X4 STAKES
SCALE: 1" = 1'-0"

(NOTE: If dowels are used, a 2 x 4 may be nailed across the cleats to support them. For ease of pouring, dowels and key way may be installed after concrete is in place.)

M. Align forms by bracing or blocking (Figure 8)

FOOTING FORMS
UNIT II

JOB SHEET #2--CONSTRUCT AND SET FORMS FOR A PILE CAP

I. Tools and materials

   A. Tools

      1. Electric handsaw
      2. Crosscut handsaw
      3. Claw hammer, 16 ounce or larger
      4. Sledge hammer
      5. Steel tape measure, 100 foot
      6. Tape measure, 12 or 16 foot
      7. Level, hand
      8. Builder's level
      9. Electric drill
      10. Chalk line
      11. Wrench, ten inch adjustable
      12. Plumb bob

   B. Materials

      1. Stakes
      2. Sheathing
      3. Spreaders
      4. Form ties
      5. 2 x 4's or 2 x 6's for braces, studs, plates, and walers
      6. Nails
         a. 8d duplex
         b. 16d duplex
         c. 6d common

JOB SHEET #2

   d. 16d common

   e. 8d common

7. Form oil

II. Procedure

A. Determine the size of the form (Figure 1)

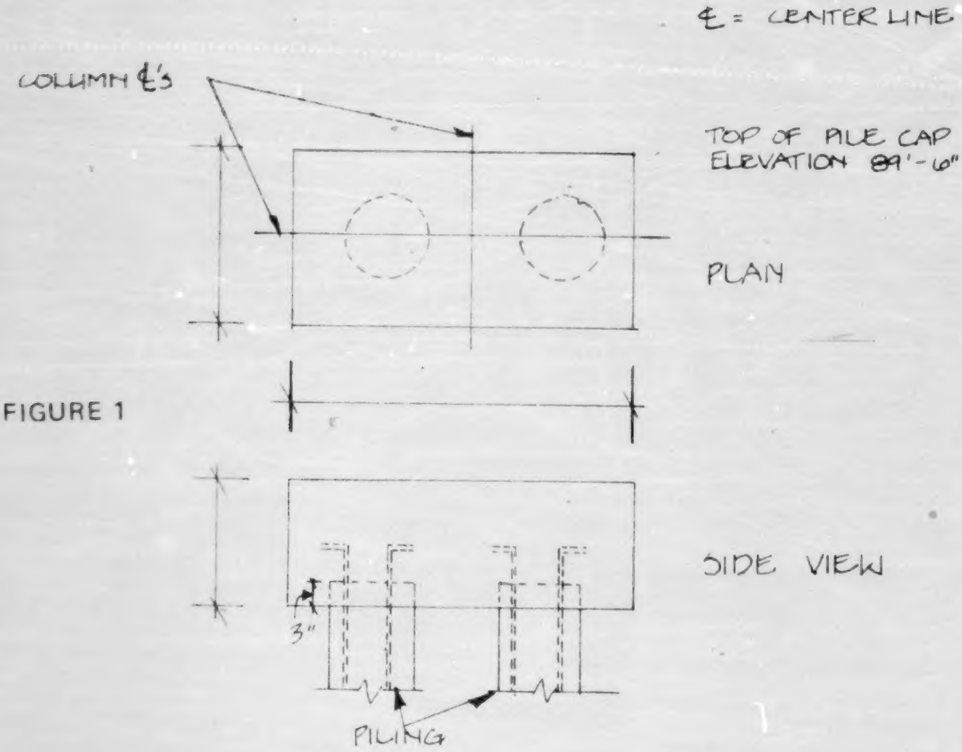

℄ = CENTER LINE
COLUMN ℄'s
TOP OF PILE CAP
ELEVATION 89'-6"
PLAN
SIDE VIEW
3"
PILING

FIGURE 1

B. Make material cut list (Figure 2)

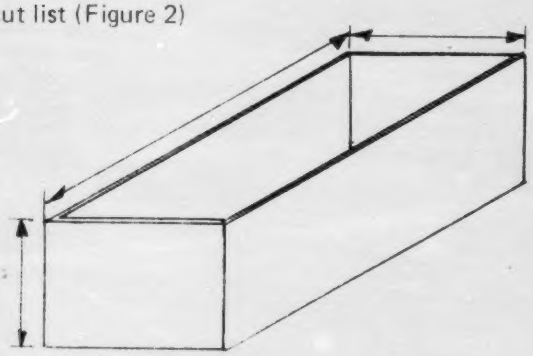


FIGURE 2

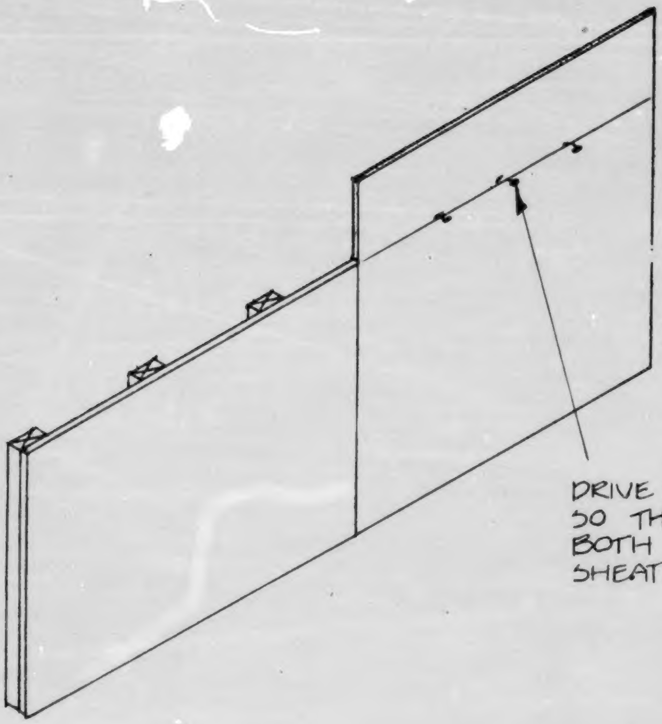
JOB SHEET #2

C. Build forms

1. Use cut list as a guide; cut studs and sheathing to length and width

   (NOTE: It is not absolutely necessary to rip plywood to width; form can be set and the grade line marked by driving nails into the sheathing. See Figure 3. Use chalk line to make grade on forms.)

FIGURE 3



DRIVE NAILS THROUGH PLYWOOD SO THEY CAN BE FOUND ON BOTH SIDES OF THE SHEATHING.

2. Lay out stud spacing (Figure 4)

   a. Lay out the first and last studs on all four panels

      (NOTE: Refer to corner detail for stud overhang of specific panel.)

JOB SHEET #2

b. Divide the remaining distance into equal spaces not exceeding 16" on center

(NOTE: Place an X [witness mark] on the side of this layout line on which the stud will be placed.)

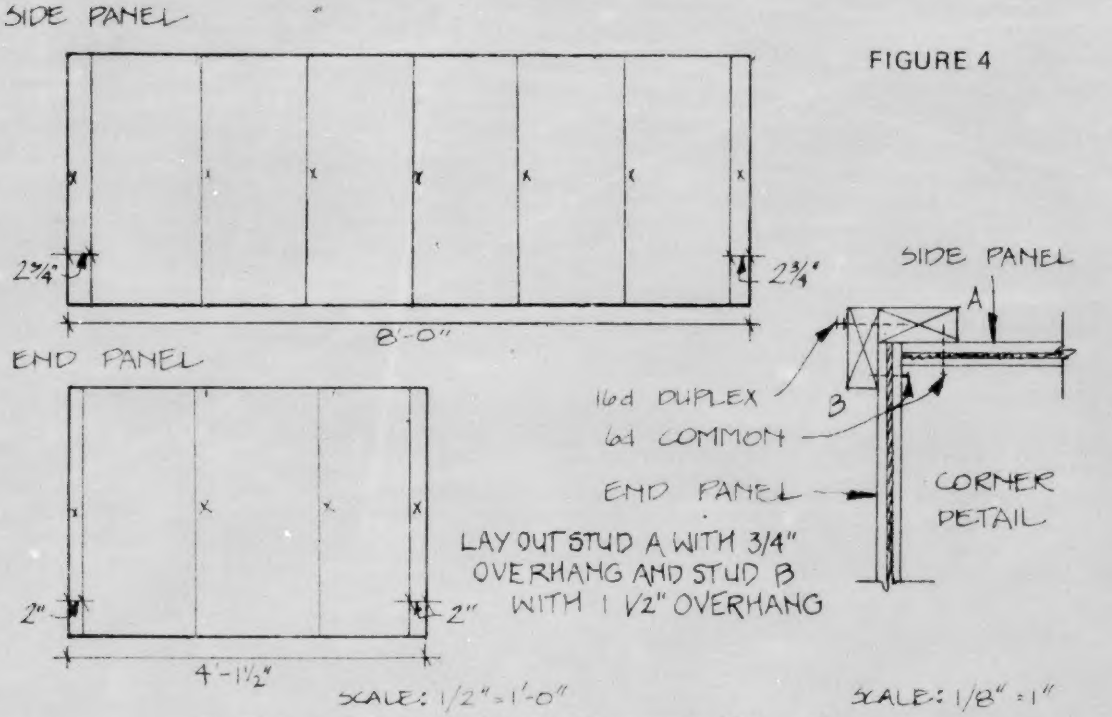


FIGURE 4

SIDE PANEL
2¾"
2¾"
8'-0"
END PANEL
2"
2"
4'-1½"
SIDE PANEL
A
16d DUPLEX
B
6d COMMON
END PANEL
CORNER DETAIL

LAY OUT STUD A WITH 3/4" OVERHANG AND STUD B WITH 1 1/2" OVERHANG

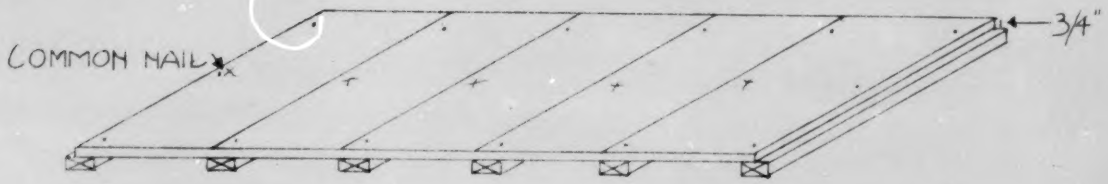
SCALE: 1/2" = 1'-0"

SCALE: 1/8" = 1"

3. Nail sheathing to studs of the four panels (Figure 5)

(NOTE: The nailing pattern, shown in Figure 5, is sufficient for one or two pours. If the forms are used on more than two, they should be nailed at one-foot centers.)

FIGURE 5

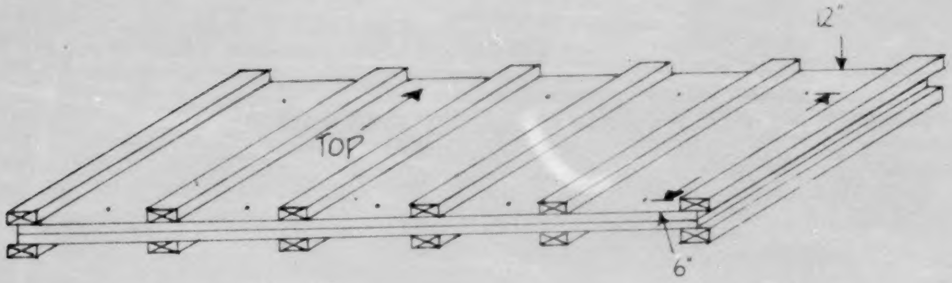


COMMON NAIL
3/4"

JOB SHEET #2

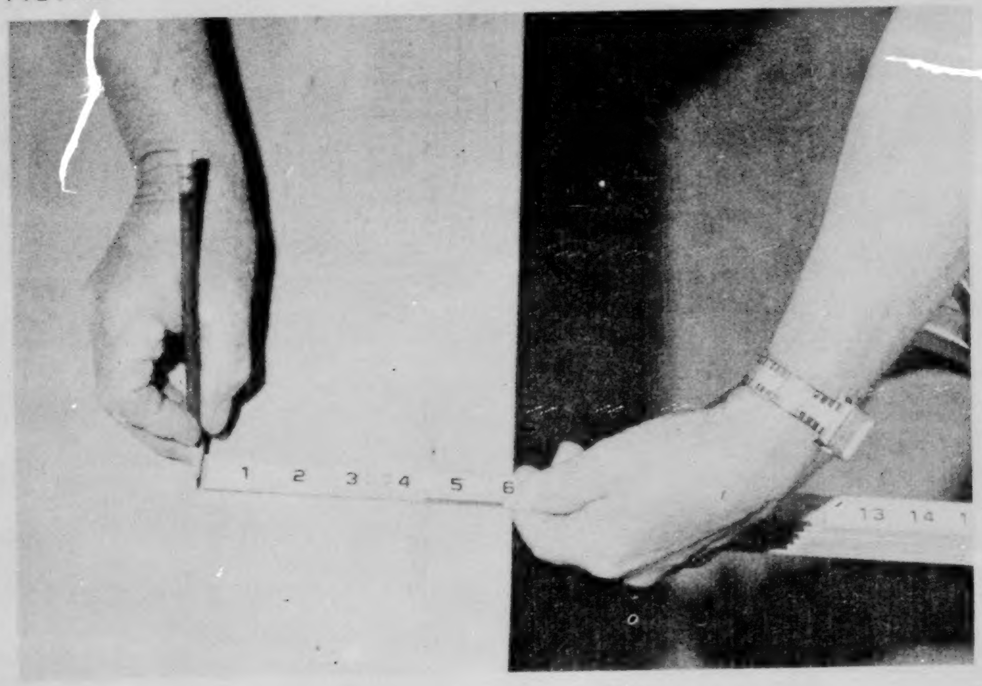
4. Drill the form tie holes (if used) (Figure 6)

FIGURE 6



(NOTE: Scribe a line for horizontal location, so the ties will line up with the slot in the waler. See Figure 7.)

FIGURE 7



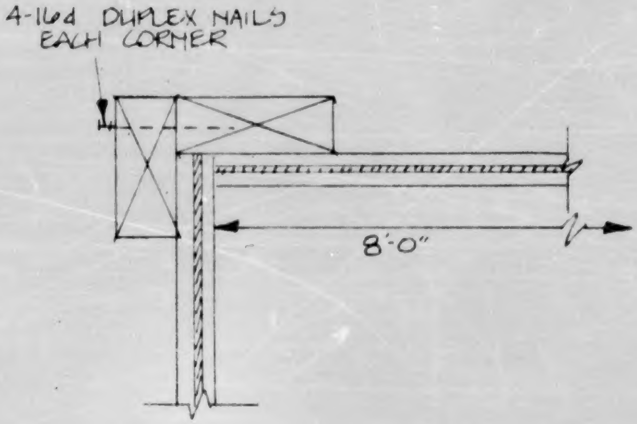
5. Set panels in excavation surrounding piles

(NOTE: Orient panels with reference marks.)

JOB SHEET #2

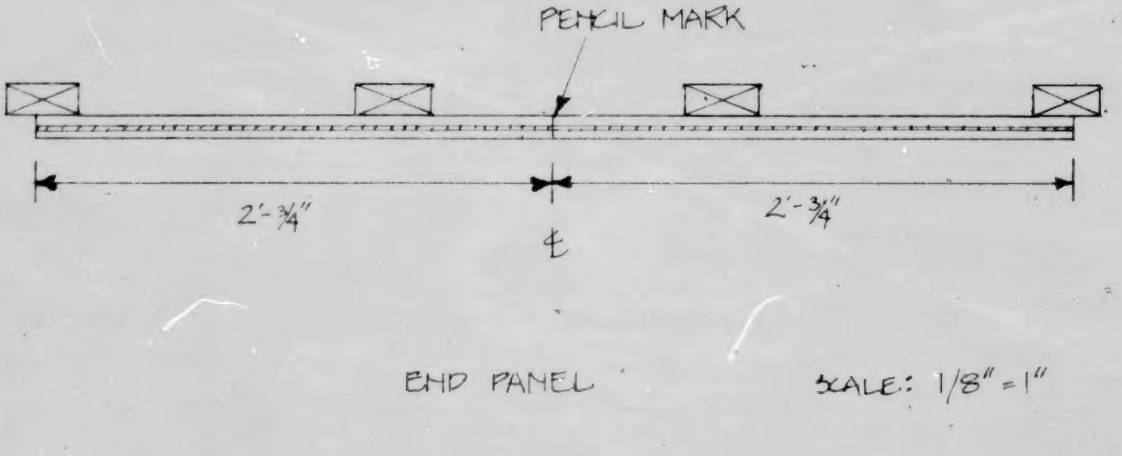
6. Nail panels together at the corners (Figure 8)

FIGURE 8


4-16d DUPLEX NAILS
EACH CORNER
8'-0"

7. Locate the center of the four sides and square a mark across the top of the sheathing (Figure 9)

FIGURE 9


PENCIL MARK
2'-3/4"
2'-3/4"
℄
END PANEL
SCALE: 1/8" = 1"

8. Set column center line stakes (Figure 10)

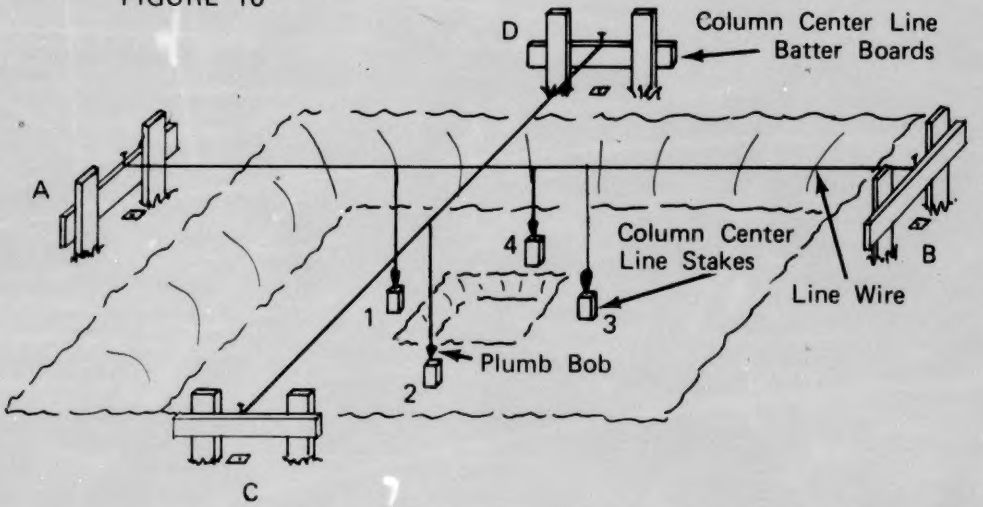
   a. Attach lines to the previously set batter boards A-B and C-D

JOB SHEET #2

b. Locate stake numbers 1, 2, 3, and 4 with a plumb bob hung from these lines

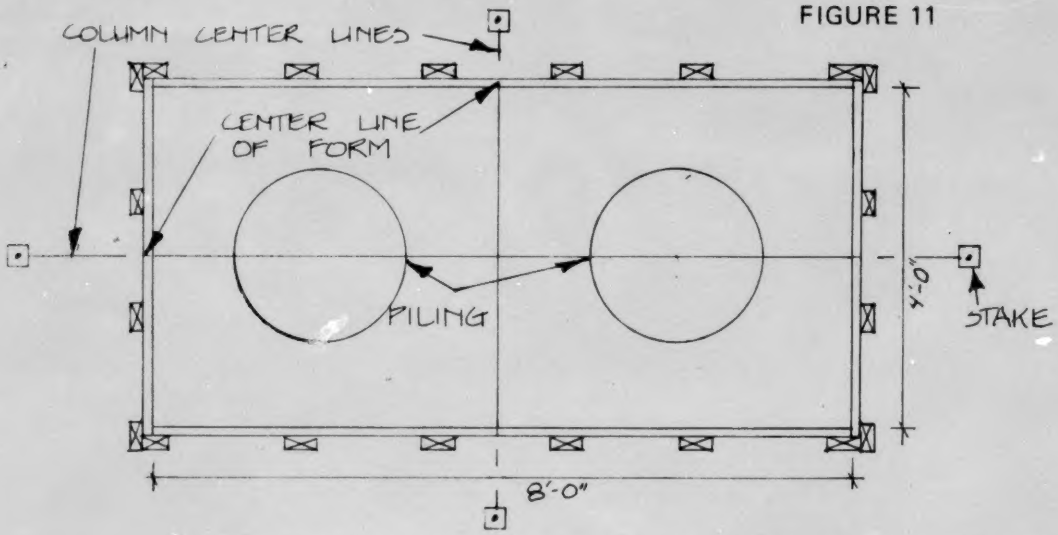
(NOTE: After stakes are driven, locate exact point of bob on stake and drive a nail in the top of the stake at this location.)

FIGURE 10


D
Column Center Line Batter Boards
A
B
Column Center Line Stakes
Line Wire
4
1
3
2
Plumb Bob
C

9. Secure line to nail in column center line stakes 1, 2, 3, and 4; pull the line taut (Figure 11)

FIGURE 11


COLUMN CENTER LINES
CENTER LINE OF FORM
PILING
4'-0"
STAKE
8'-0"

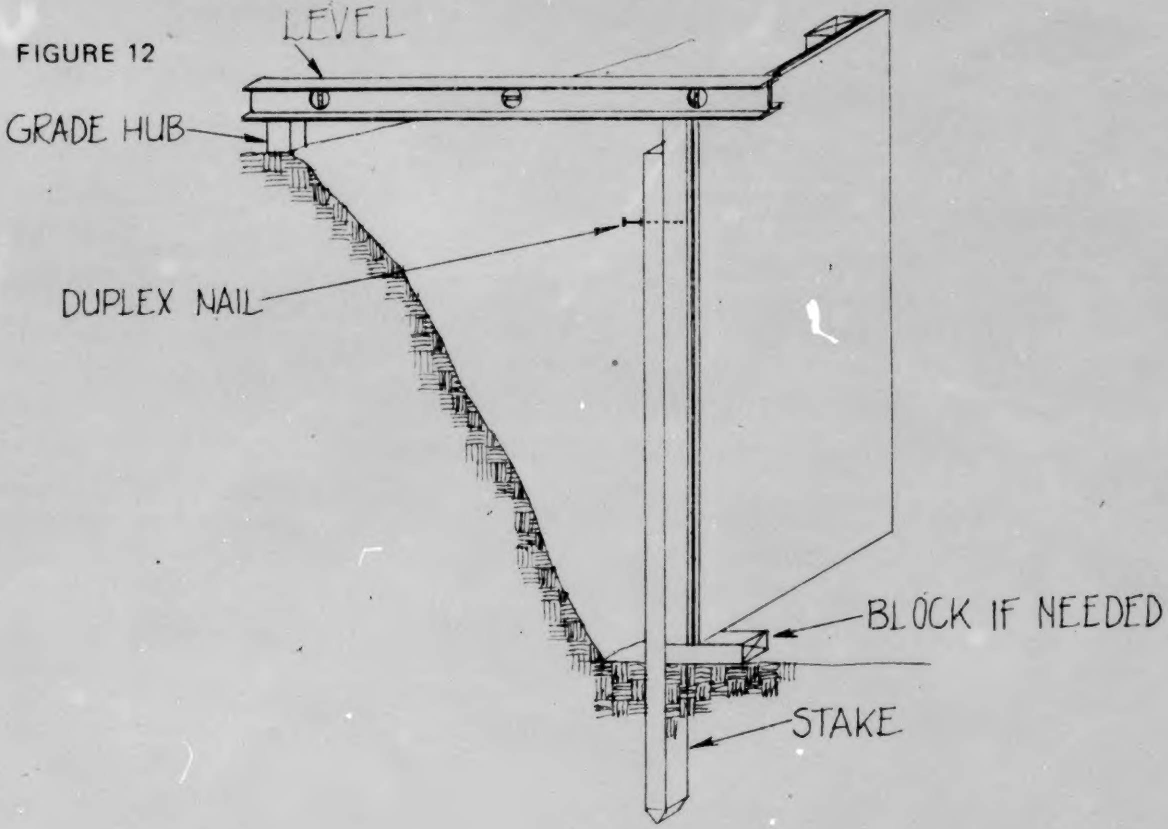
10. Line up, from center line, marks with column center lines (Figure 11)

11. Drive stakes at corners of form to hold it in position

JOB SHEET #2

12. Bring form to grade by blocking up and nailing to stake (Figure 12)

FIGURE 12



(NOTE: Form oil must be applied before rebar installation.)

13. Install form ties

14. Install walers

    (NOTE: If form ties are not used, walers may be 2 x 4 or larger and should be nailed flat against the form.)

15. Cut spreaders to width of form; place at top and bottom of the form under the center line mark

16. Install buttons on form ties on one side and one end of the form

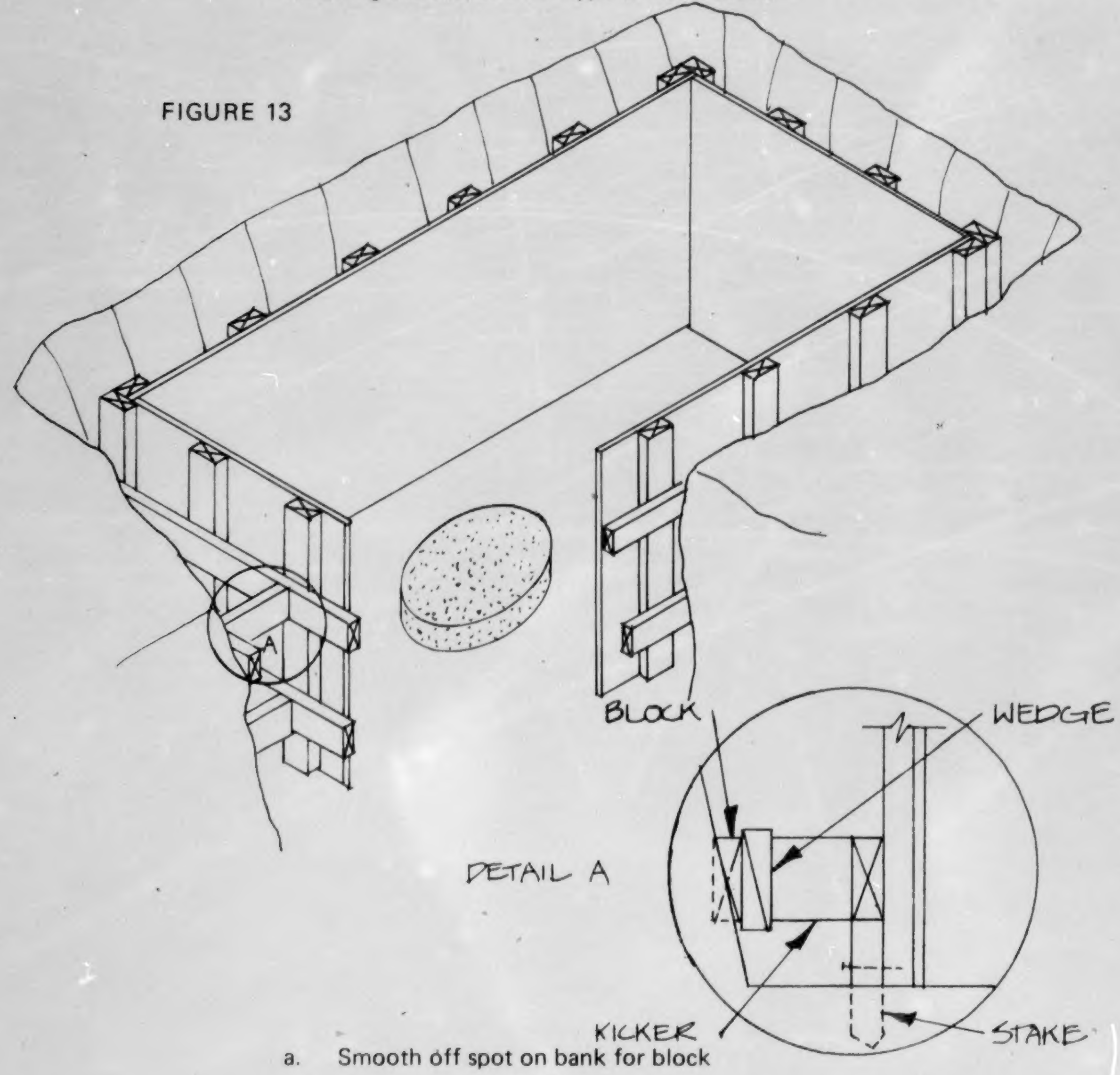
17. Install buttons on form ties on the opposite sides; pull form tightly against spreaders and secure buttons

JOB SHEET #2

18. Install form without ties (Figure 13)

    (NOTE: All procedures are the same except for drilling tie holes, installing the ties, and the type of waler used.)

FIGURE 13



    a. Smooth off spot on bank for block

    b. Place block on smooth spot and measure from face of block to face of waler to secure kicker length

    c. Cut kicker

    d. Install kicker and block as shown on Figure 13, Detail A

JOB SHEET #2

e. Install kickers at top and bottom walers, spaced horizontally as needed

(NOTE: Nail kickers securely so they do not vibrate out.)

FOOTING FORMS
UNIT III

JOB SHEET #3--CONSTRUCT AND SET FORMS FOR A PIER FOOTING

I. Tools and materials

   A. Tools

      1. Electric handsaw
      2. Crosscut handsaw
      3. Claw hammer, 16 oz or larger
      4. Sledge hammer
      5. Steel tape measure, 100 foot
      6. Tape measure, 12 or 16 foot
      7. Level, hand
      8. Builder's level
      9. Electric drill and bits
      10. Chalk line
      11. Wrench, ten inch adjustable
      12. String line or wire
      13. Plumb bob
      14. Framing square

   B. Materials

      1. Stakes
      2. Sheathing
         a. 3/4" plywood
         b. 2 x 10's
      3. Spreaders
      4. Form ties
      5. 2 x 4's or 2 x 6's for braces, studs, and hanger

JOB SHEET #3

6. Nails
    a. 8d duplex
    b. 16d duplex
    c. 6d common
    d. 16d common
    e. 8d common
7. Form oil
8. Column clamps

II. Procedure

A. Determine the size of the form (Figures 1a and 1b)

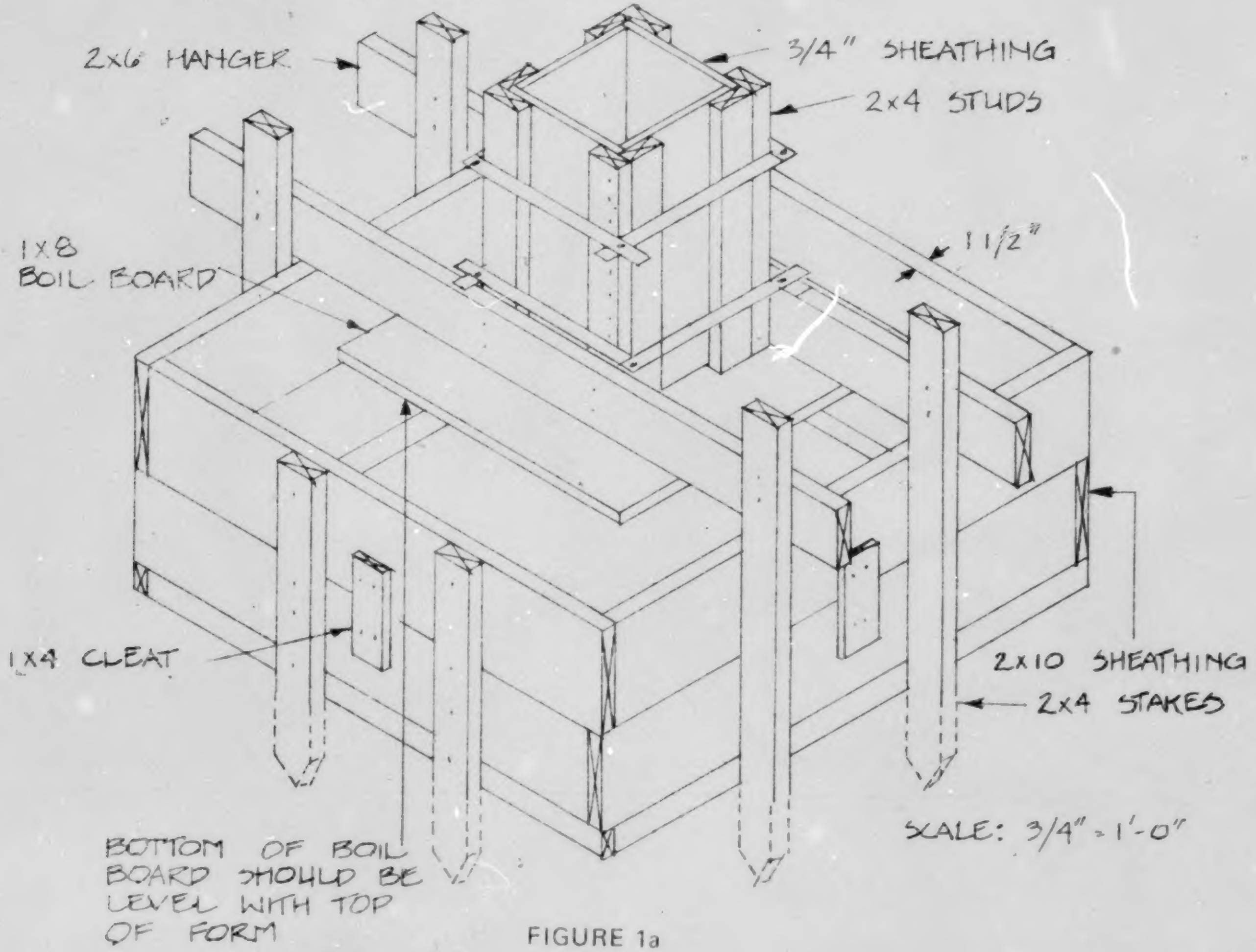
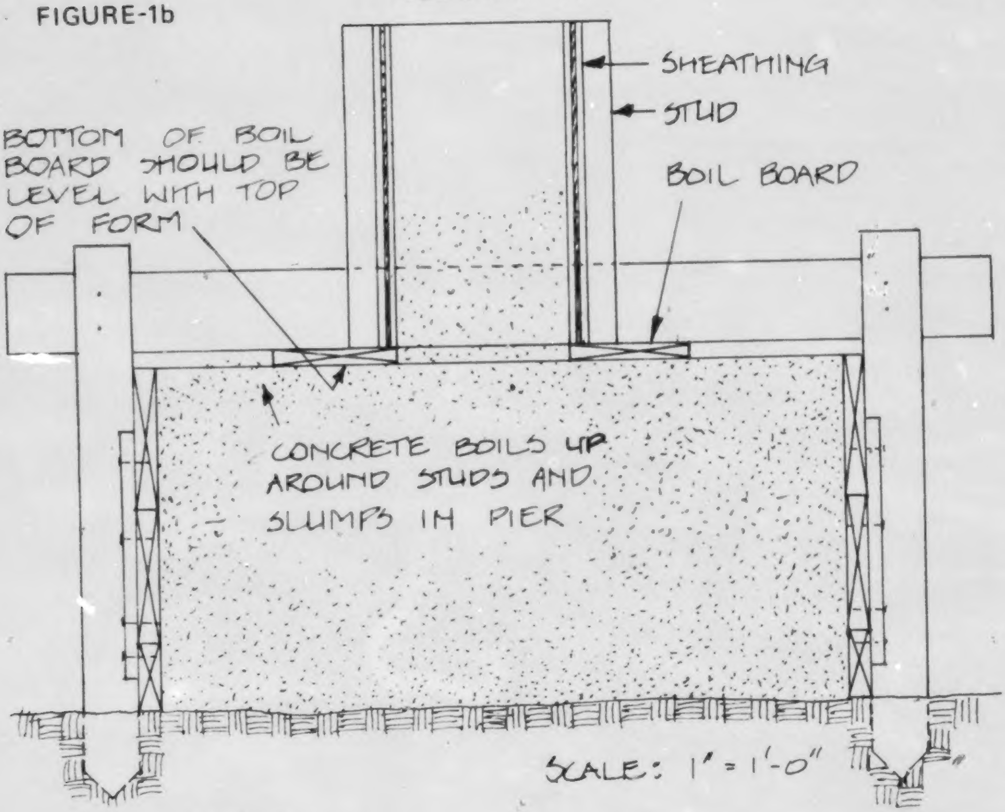

2x6 HANGER
3/4" SHEATHING
2x4 STUDS
1x8
BOIL BOARD
1 1/2"
1x4 CLEAT
2x10 SHEATHING
2x4 STAKES
SCALE: 3/4" = 1'-0"
BOTTOM OF BOIL BOARD SHOULD BE LEVEL WITH TOP OF FORM

FIGURE 1a

JOB SHEET #3

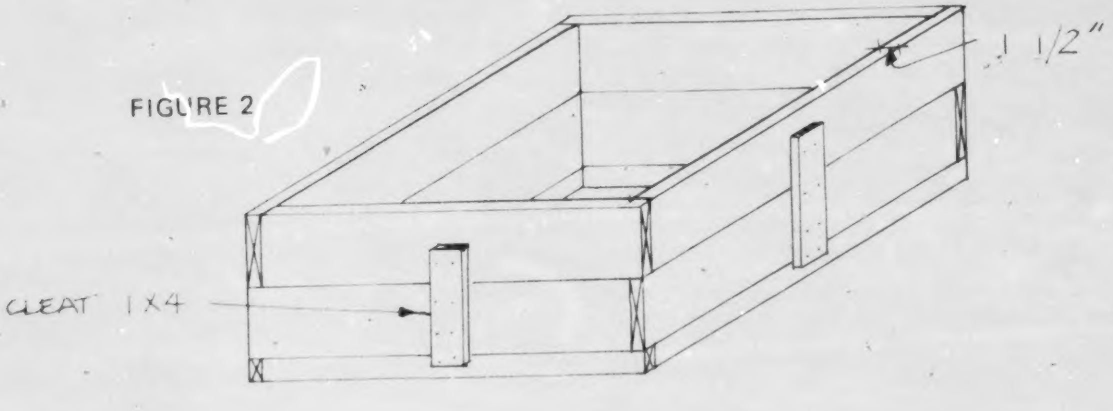
FIGURE-1b


SHEATHING
STUD
BOTTOM OF BOIL BOARD SHOULD BE LEVEL WITH TOP OF FORM
BOIL BOARD
CONCRETE BOILS UP AROUND STUDS AND SLUMPS IN PIER
SCALE: 1" = 1'-0"

B. Build the forms

1. Make a material cut list (Figure 1a)
2. Cut material to size using the material cut list
3. Build the bottom form (Figure 2)

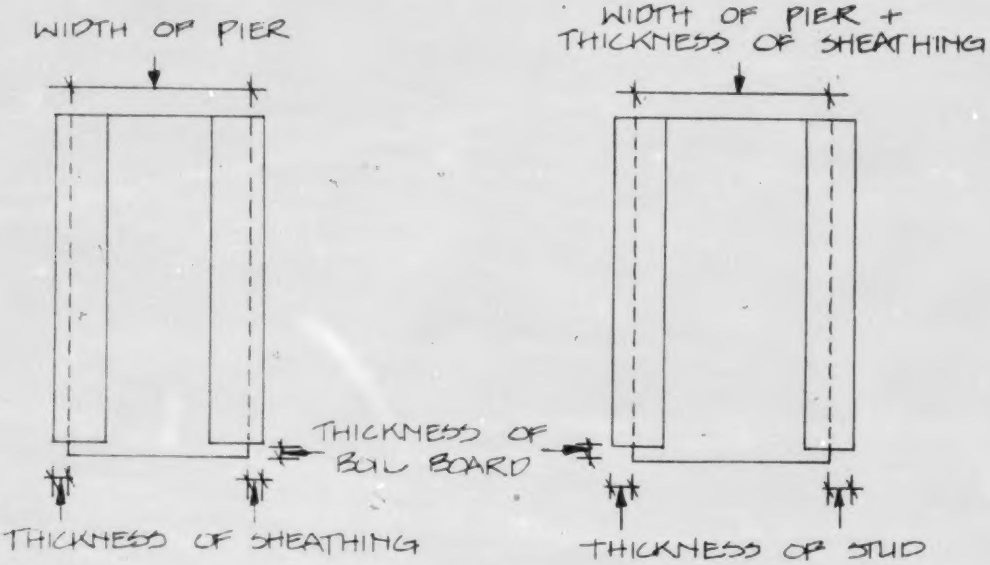
FIGURE 2


1 1/2"
CLEAT 1X4

JOB SHEET #3

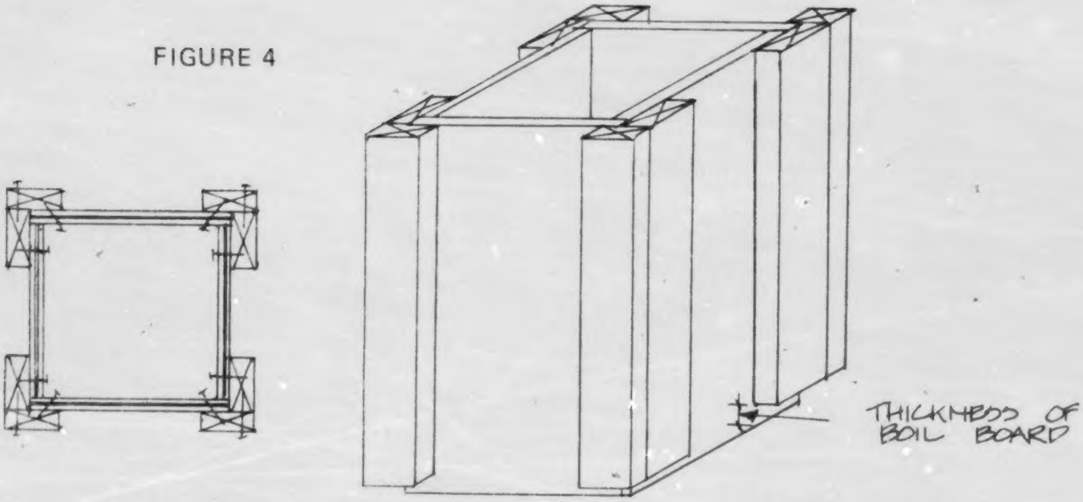
4. Build the pier form panels (Figure 3)

FIGURE 3


WIDTH OF PIER
WIDTH OF PIER + THICKNESS OF SHEATHING
THICKNESS OF BOIL BOARD
THICKNESS OF SHEATHING
THICKNESS OF STUD

5. Nail the panels together (Figure 4)

FIGURE 4

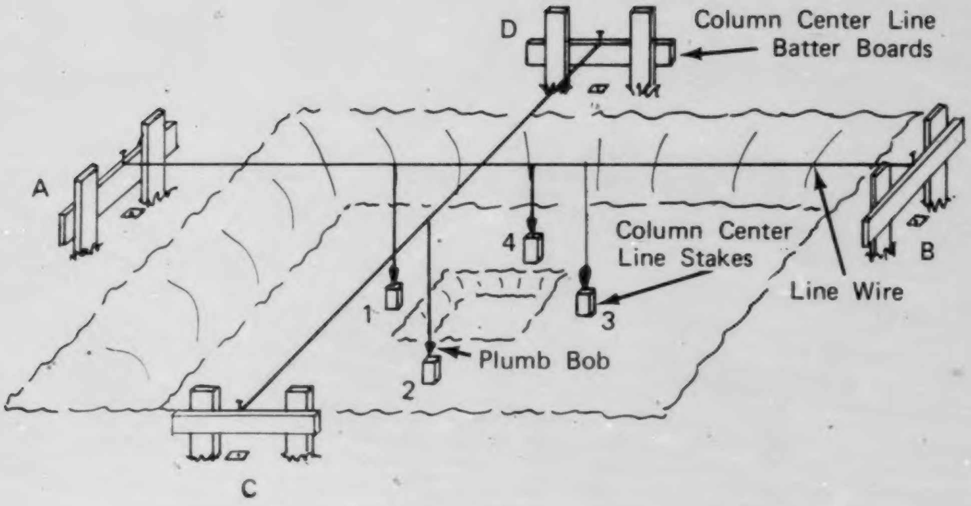

THICKNESS OF BOIL BOARD

6. Coat both forms with form oil

JOB SHEET #3

C. Locate and set column center line stakes (Figure 5)

FIGURE 5


D
Column Center Line
Batter Boards
A
B
4
Column Center
Line Stakes
3
Line Wire
1
2
Plumb Bob
C

1. Stretch a line from points A-B and C-D
2. Establish center line stake numbers 1, 2, 3, and 4 using a plumb bob

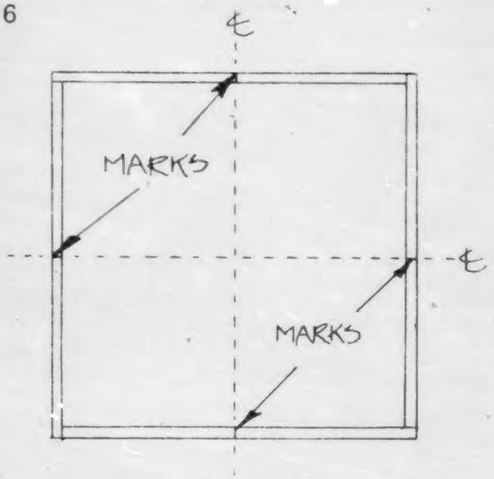
JOB SHEET #3

D. Set the form

1. Set bottom form section in excavation

2. Mark center line on all four sides of the form (Figure 6)

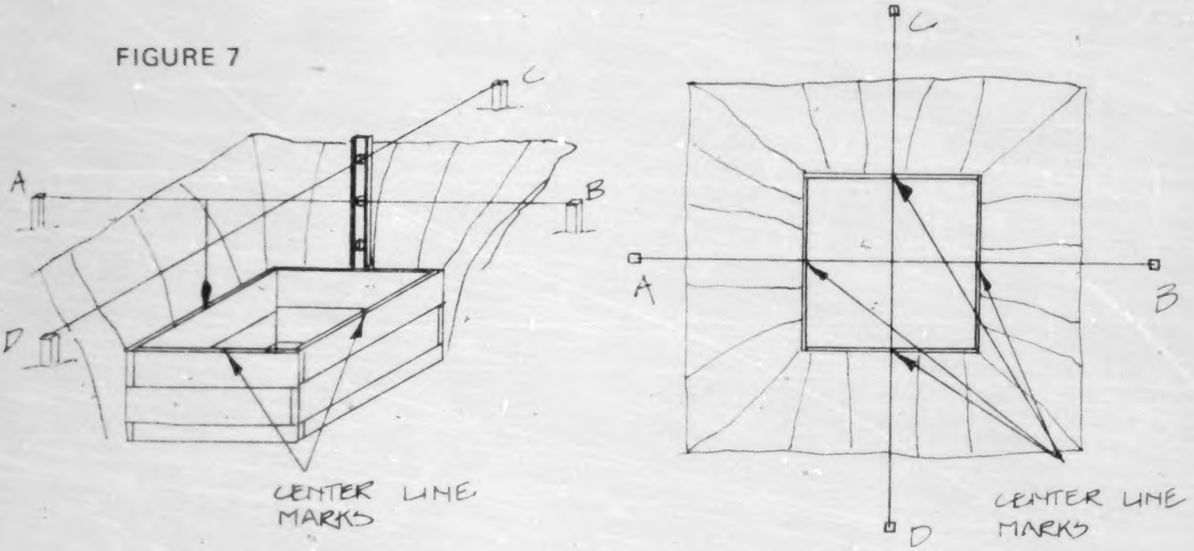
FIGURE 6


℄
MARKS
℄
MARKS

3. Stretch a line between stakes A-B and C-D; pull it taut (Figure 5)

4. Locate form with center line marks directly under column center lines using a plumb bob or hand level (Figure 7)

FIGURE 7


C
A
B
D
CENTER LINE MARKS
C
A
B
D
CENTER LINE MARKS

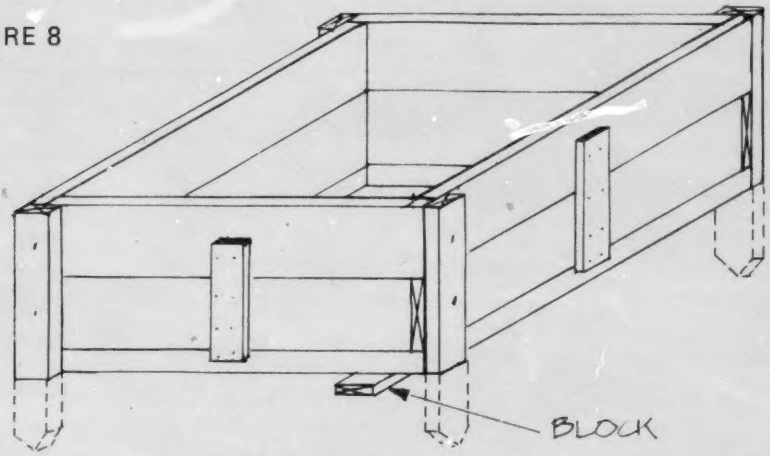
5. Drive stakes at four corners of the form

JOB SHEET #3

6. Block up to grade and nail to stakes (Figure 8)

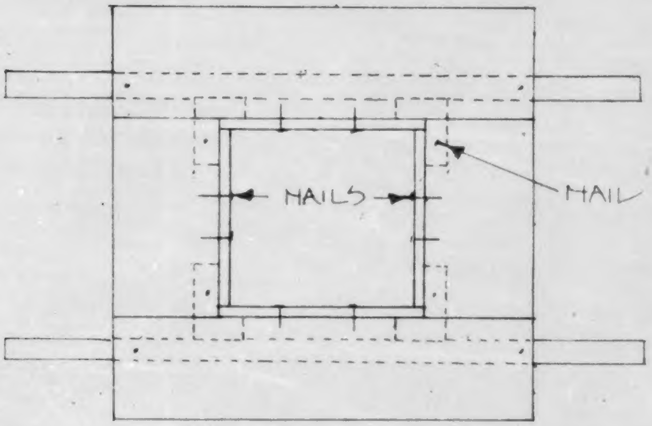
   (NOTE: Use builder's level and leveling rod to establish grade from bench mark to the corners of the form.)

FIGURE 8



7. Turn pier panel upside down and install boil boards and hangers (Figure 9)

FIGURE 9



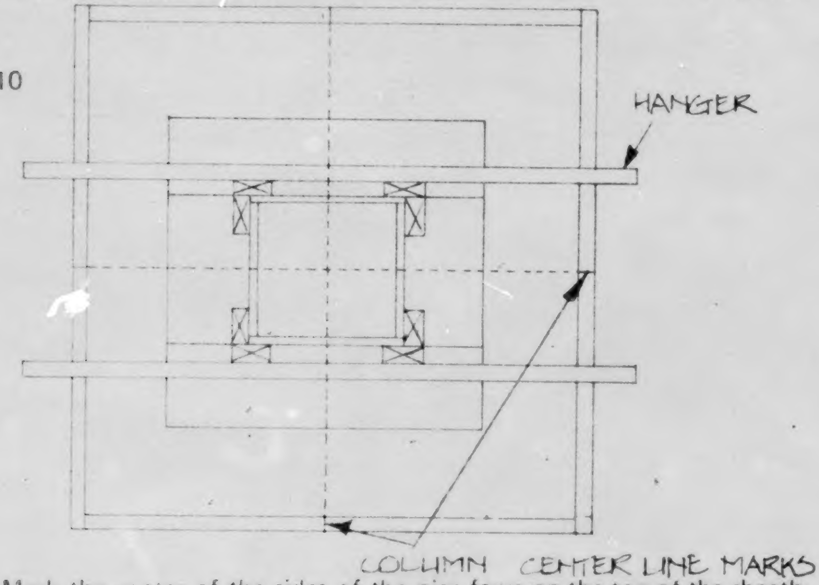
(NOTE: Install hanger so it is parallel to the short boil boards.)

JOB SHEET #3

8. Set pier form on bottom form and position it approximately on the column center line marks (Figure 10)

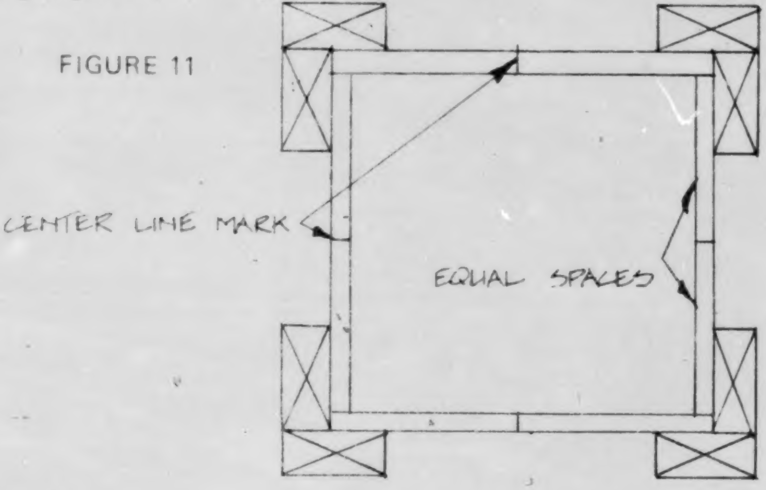
   (NOTE: Raise hangers. Place a block between it and the lower form at the four points on which the hanger sits; tack the block in place.)

FIGURE 10


HANGER
COLUMN CENTER LINE MARKS

9. Mark the center of the sides of the pier form on the top of the sheathing (Figure 11)

FIGURE 11


CENTER LINE MARK
EQUAL SPACES

10. Plumb down from column center line to the marks on the top of the pier

    (NOTE: This is the same as setting the bottom form in Figure 6.)

11. Nail hangers to bottom form

JOB SHEET #3

12. Drive stakes along the side of the form and the hanger

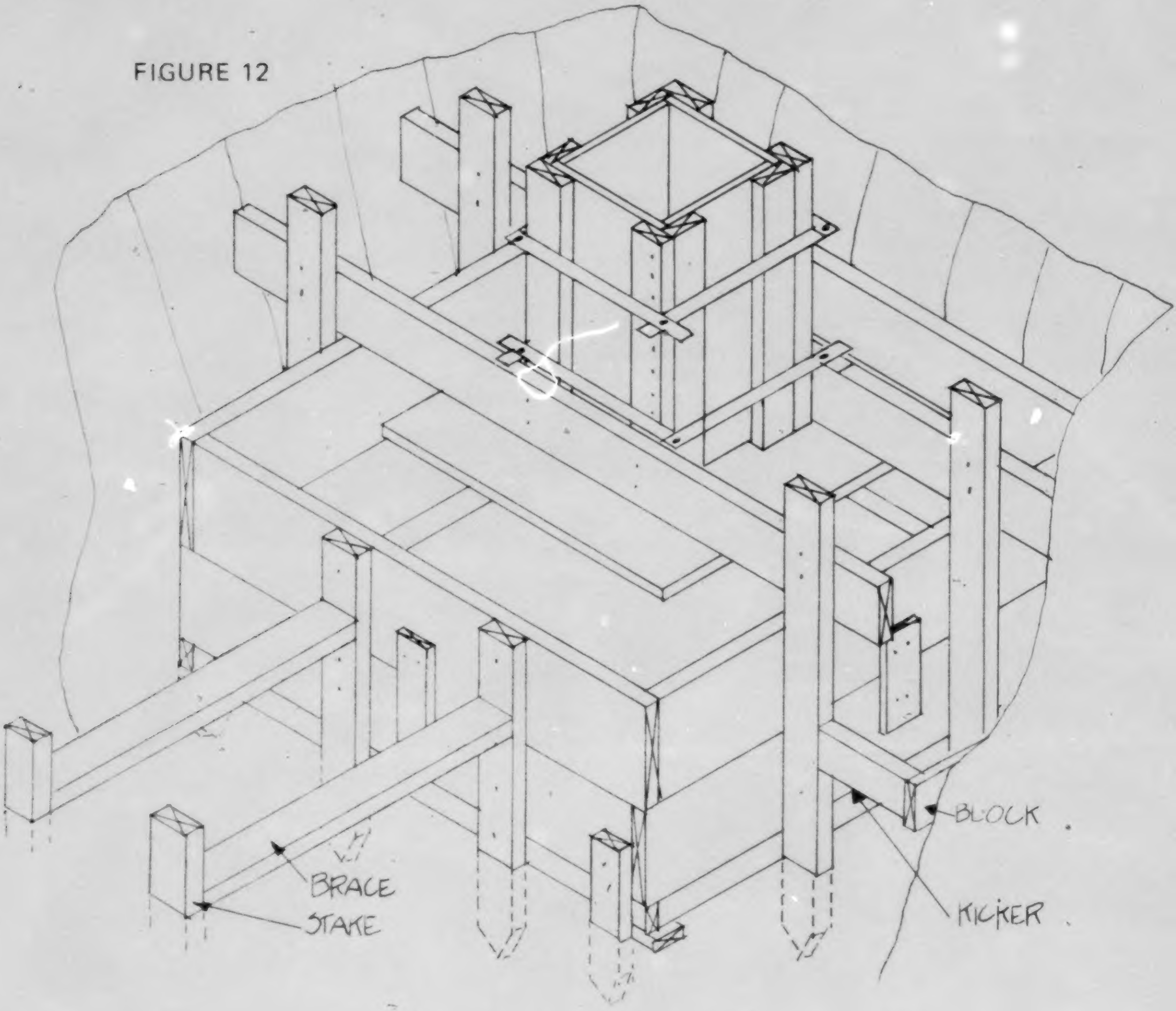
13. Check alignment of pier; if it is still okay, nail stakes to hangers (Figure 1a)

14. Install column clamps

    (NOTE: Position one on top of hanger and one six inches from the top of the pier form. See Figure 1. If piers are over two feet high, more clamps will be needed.)

15. Brace or use kicker on the bottom form (Figure 12)

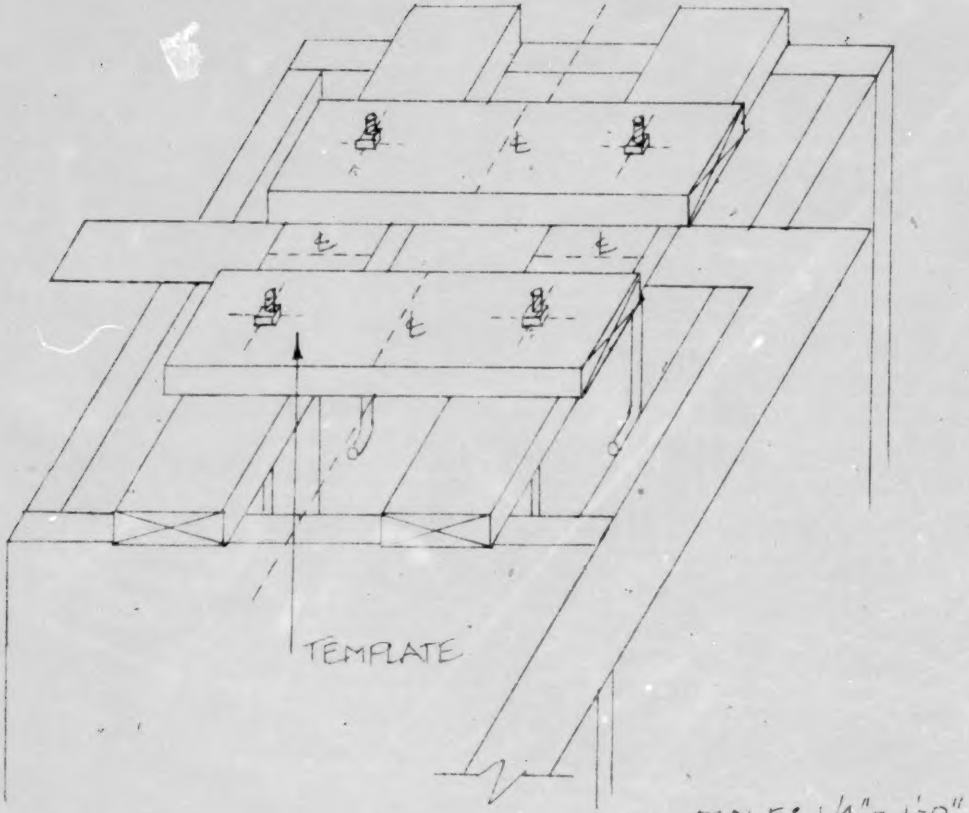
FIGURE 12



JOB SHEET #3

E. Build and set bolt template (Figure 13)

FIGURE 13



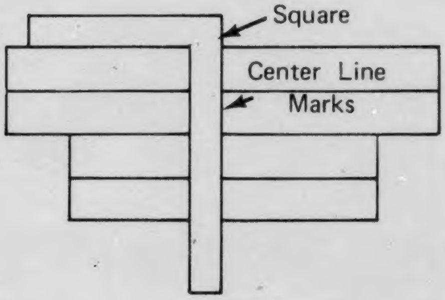
1. Cut two pieces of 1 × 3 long enough to reach across the top of the pier form

2. Cut two pieces three inches longer than the center line spacing of the bolts

JOB SHEET #3

3. Make a center line mark across the four pieces (Figure 14)

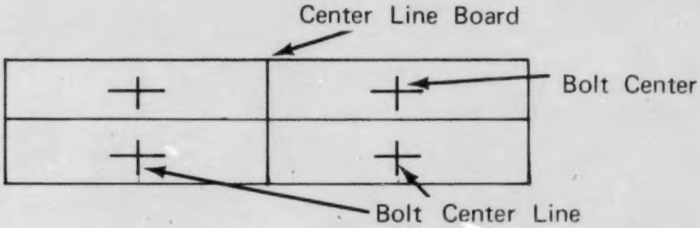
FIGURE 14


Square
Center Line
Marks

4. Lay out the bolt spacing on the length of the two short boards; cross these lines with a center line mark on the width (Figure 15)

(NOTE: Accuracy is of the utmost importance in all bolt layout.)

FIGURE 15

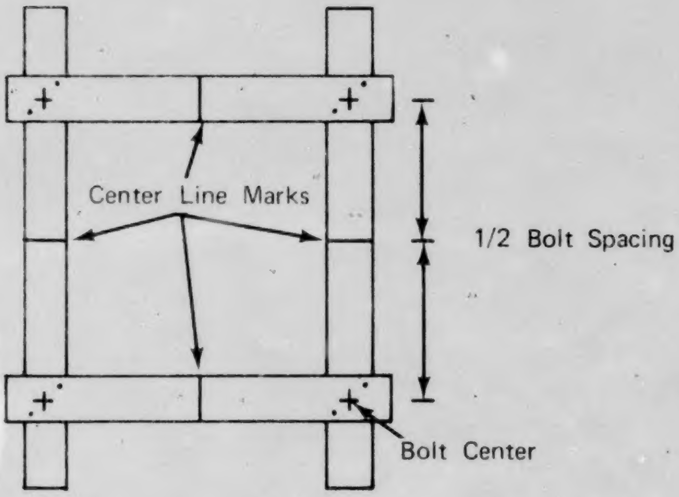

Center Line Board
Bolt Center
Bolt Center Line

JOB SHEET #3

5. Nail the four pieces together (Figure 16)

   (NOTE: Check template for square and bolt centers for distance before nailing securely.)

FIGURE 16


Center Line Marks
1/2 Bolt Spacing
Bolt Center

6. Drill holes at crosses marking bolt center

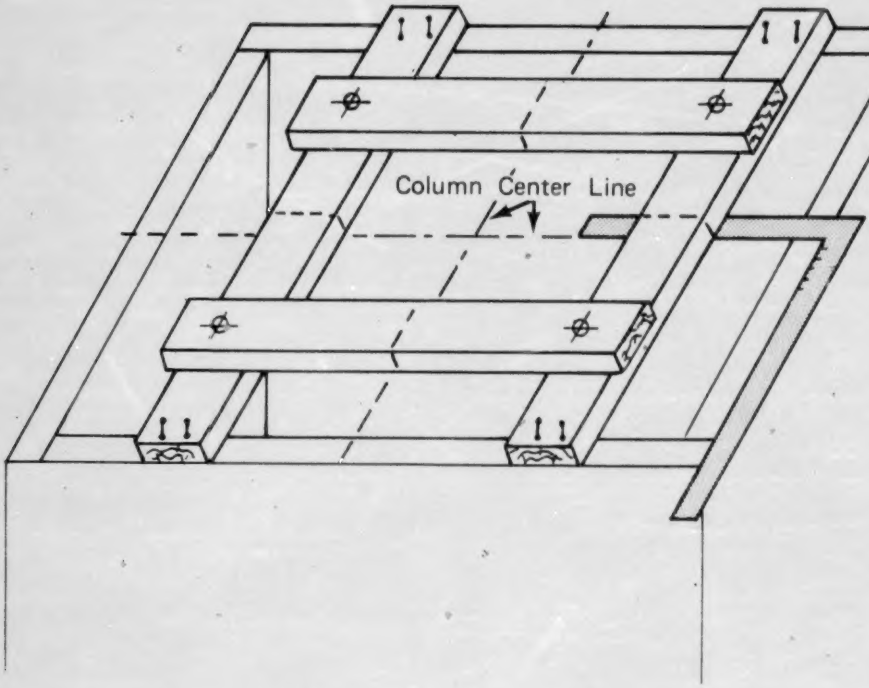
   (NOTE: Holes should not be more than 1/16" larger than the bolt.)

JOB SHEET #3

7. Set template on pier form using a square to locate it on the column center lines; nail securely to form (Figure 17)

   (NOTE: Recheck bolts for location and plumb after concrete is poured.)

FIGURE 17



FOOTING FORMS
UNIT II

JOB SHEET #4--STRIP PIER FOOTING FORMS AND PREPARE FOR ERECTION AT ANOTHER LOCATION

I. Tools and materials

  A. Tools

    1. Wrecking bar

    2. Claw hammer, 16 ounces or larger

    3. Large brush, spray can, roller, or mop

  B. Materials--Form oil

II. Procedure

  A. Stripping forms

  (NOTE: Remove in the reverse order of setting.)

    1. Remove pier form

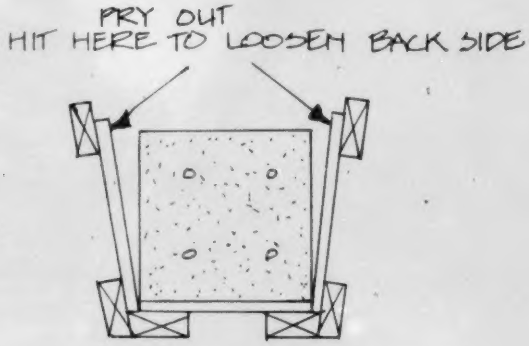
      a. Remove the duplex nails from two corners of the form

      b. Pry this side from the pier

      (CAUTION: Do not pry against the green concrete.)

      c. Remove the remaining three sides as one unit (Figure 1)

FIGURE 1



    2. Remove hangers

    (NOTE: Care should be taken not to damage the form parts any more than necessary so that they may be reused.)

JOB SHEET #4

3. Remove column clamps
4. Remove braces, kickers, and cleats
5. Remove the duplex nails from one corner of the bottom forms
6. Spread forms apart at this corner and remove in one unit

B. Preparing for erection at next location

1. Renail single pier panel to three panel sections

   (NOTE: If boil board was damaged, replace it.)
2. Attach hangers
3. Renail corner of bottom form sections
4. Coat inside of forms with form oil
5. Transfer all parts to next location

FOOTING FORMS
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by writing the appropriate numbers in the blanks provided.

______a. Wire or metal crosstie used to hold the pressure of wet concrete and maintain the proper wall thickness

______b. Beveled strip of wood or metal placed on the form where future pours occur

______c. Block of wood or other material used as a spacer at offsets in a form

______d. Wide boards, plywood, or metal that make up the face of the form

______e. Short piece of steel bar inserted through a bulkhead to tie adjoining pours together

______f. Piece of material nailed across a splice to strengthen and hold it together

______g. Board placed in a form to cut off the concrete pour

______h. Small boards or steel bars sharpened on one end and driven into the ground to support a form

______i. Block of wood that is used to hold the sides of the form apart; is removed as the concrete is poured; may also be an integral part of the form tie

______j. Machine used to transport concrete from the mixer to the pour site

______k. Power tool used to consolidate concrete

______l. Level of the finished concrete in a form

______m. Receptacle, usually funnel-shaped, open, or with a gate at the bottom

______n. Continuous mass of concrete cast as a single unit

1. Scab
2. Sheathing
3. Spreader
4. Form tie
5. Spacer block
6. Key
7. Stakes
8. Vibrator
9. Power buggy
10. Dowel
11. Bulkhead
12. Grade point
13. Monolithic pour
14. Hopper

______o. That portion of a wall upon which the structure rests

______p. Groove left in the concrete by removal of the key

______q. Paraffin oil or other manufactured product used on a form to prevent adhesion of concrete to the form

______r. Double-headed nail used in forming and designed for easy removal

______s. Piece of wood or other material that directs, resists, or supports weight or pressure

______t. Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

______u. Enlarged area at the base of a wall or another object used to distribute the weight of the superstructure

______v. Process of removing a form after the concrete has set

______w. Wide board placed around the bottom of a form to keep the concrete from rising up around the form

______x. Vertical distance from the bench mark to the line of sight of the instrument

______y. Boundaries of a lot or plot of ground

______z. Sawed line in which to fit string line to hold it in place

______aa. Upright architectural member treated as a column; usually projects a third or less of its width from the wall

______bb. Horizontal brace used in form construction

______cc. Tapered piece of wood or metal

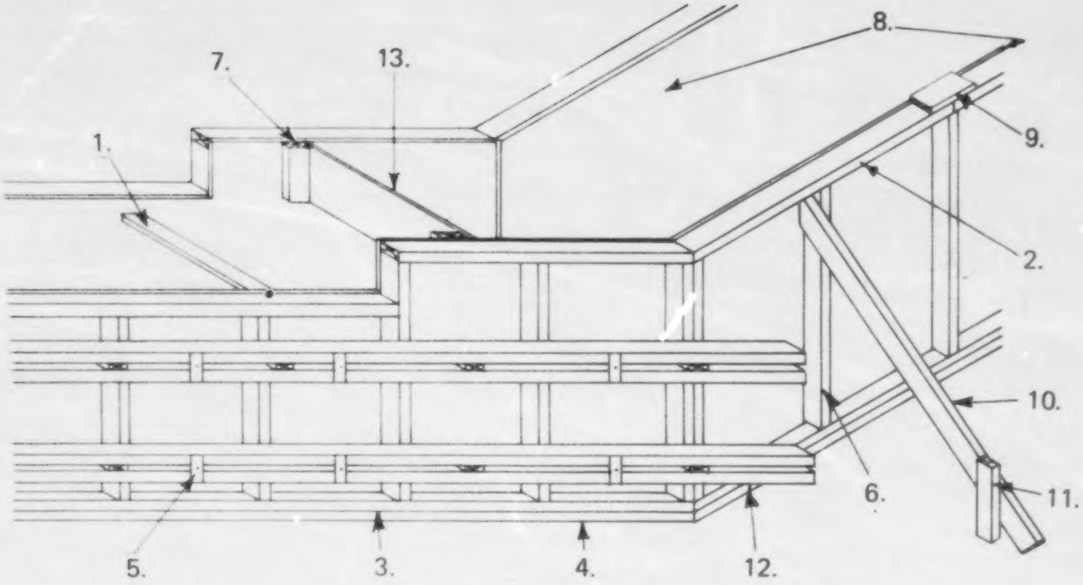
15. Foundation
16. Strip form
17. Footing
18. Brace
19. Boil board
20. Duplex nail
21. Form oil
22. Height of instrument (HI)
23. Wedge
24. Pilaster
25. Waler
26. Kerf
27. Key way
28. Property line
29. Cleat

2. Write the purpose of forms.

____

____

3. Identify the parts of a form by placing the correct numbers in the corresponding blanks.



_____a. Cleat

_____b. Spreader

_____c. Stud

_____d. Form tie

_____e. Sole plate

_____f. Stake

_____g. Bottom plate

_____h. Waler

_____i. Brace

_____j. Top plate

_____k. Sheathing

_____l. Scab

_____m. Bulkhead

4. Identify types of footings on the following pages by placing the correct numbers in the blanks provided.

_____ a. Continuous

_____ b. Pile cap

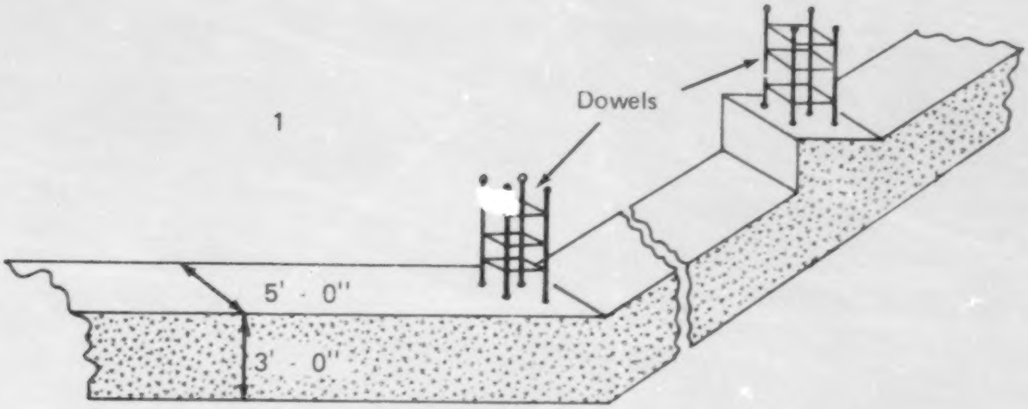
_____ c. Pier

_____ d. Grade beam

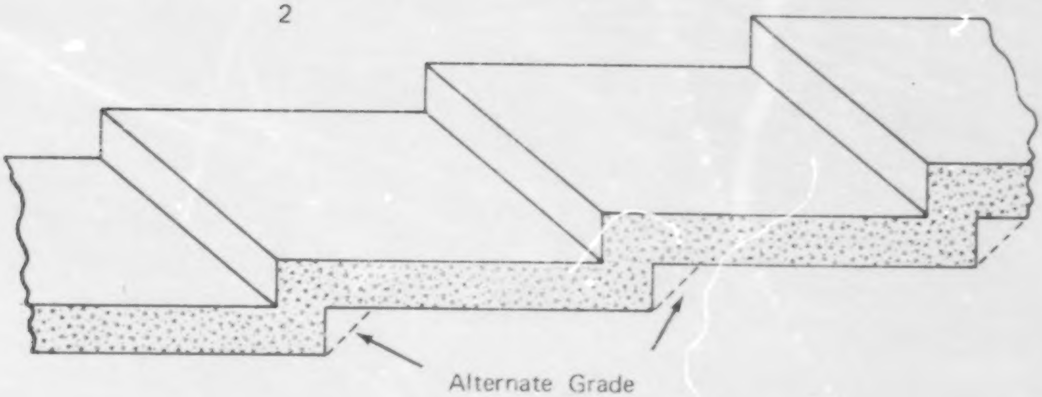
_____ e. Grillage

_____ f. Stepped (continuous)

1

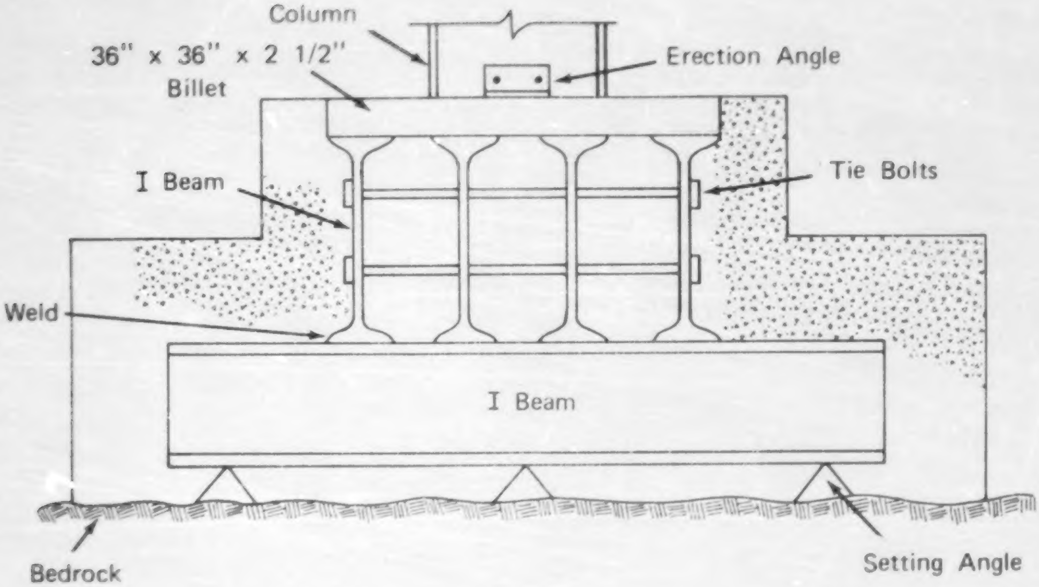

Dowels
5' - 0''
3' - 0''

2

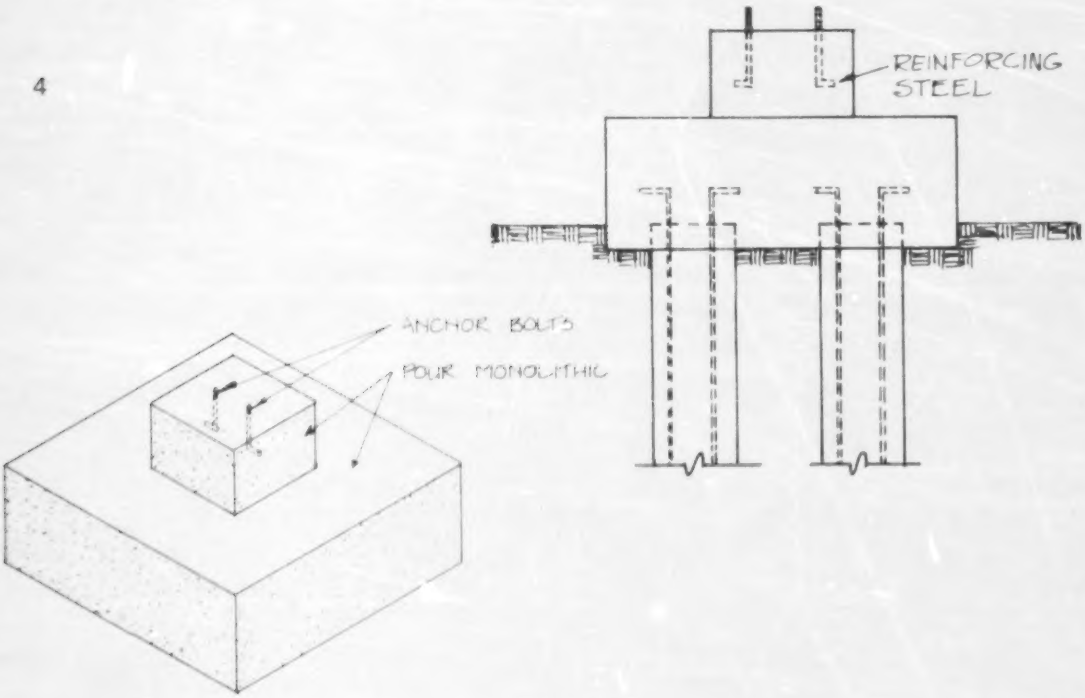

Alternate Grade

(NOTE: Illustrations are continued on the next two pages.)

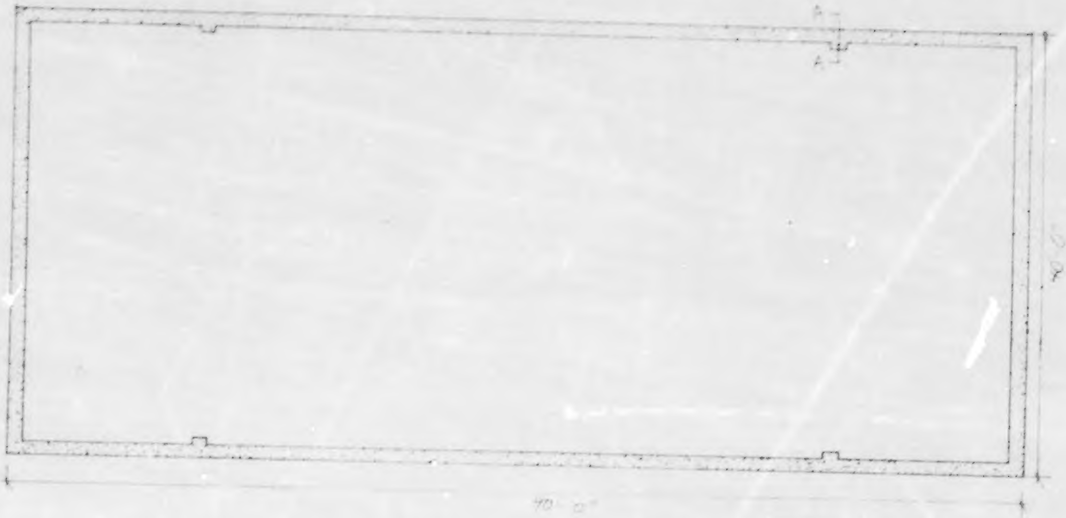
3


Column
36" x 36" x 2 1/2" Billet
Erection Angle
I Beam
Tie Bolts
Weld
I Beam
Bedrock
Setting Angle

4

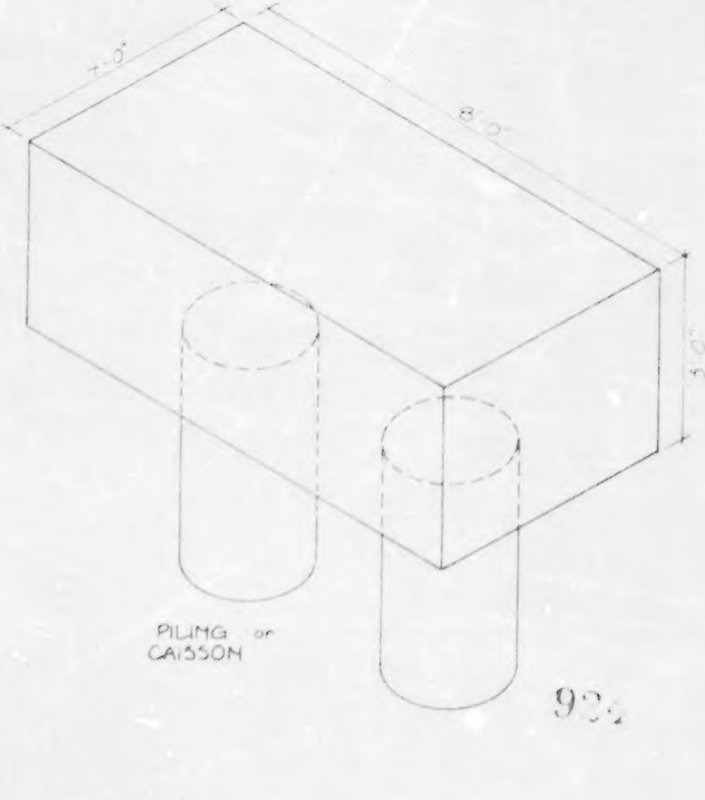

REINFORCING STEEL
ANCHOR BOLTS
POUR MONOLITHIC

5



SECTION A-A

6


7'-0"
8'-0"
3'-0"
PILING or
CAISSON

5. Name methods of form construction.

   a. ____

   b. ____

6. Demonstrate the ability to:

   a. Construct and set forms for a continuous footing.

   b. Construct and set forms for a pile cap.

   c. Construct and set forms for a pier footing.

   d. Strip pier footing forms and prepare for erection at another location.

   (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

FOOTING FORMS
UNIT II

ANSWERS TO TEST

1. a. 4
   b. 6
   c. 5
   d. 2
   e. 10
   f. 1
   g. 11
   h. 7
   i. 3
   j. 9
   k. 8
   l. 12
   m. 14
   n. 13
   o. 15
   p. 27
   q. 21
   r. 20
   s. 18
   t. 29
   u. 17
   v. 16
   w. 19
   x. 22
   y. 28
   z. 26
   aa. 24
   bb. 25
   cc. 23
2. To hold wet concrete to the desired shape until it has set
3. a. 7
   b. 1
   c. 6
   d. 5
   e. 4
   f. 11
   g. 3
   h. 12
   i. 10
   j. 2
   k. 8
   l. 9
   m. 13

4. a. 5
   b. 6
   c. 4
   d. 1
   e. 3
   f. 2
5. a. Built-on-site
   b. Patented
6. Performance skills evaluated to the satisfaction of the instructor

EDGE FORMS ON GRADE
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the parts of an edge form, name types of pours on which edge forms are used, and name types of edge forms. The student should be able to construct edge forms. This knowledge will be evidenced by completion of job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with edge forms on grade to the correct definitions.
2. Identify the parts of an edge form.
3. Name types of pours using edge forms.
4. Name types of edge forms.
5. Demonstrate the ability to:
    a. Construct edge forms for a slab on grade without foundation.
    b. Construct edge forms for a slab on grade with foundation.
    c. Construct edge forms for a patio.

EDGE FORMS ON GRADE
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide student with objective sheet.

   B. Provide student with information and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and job sheets.

   F. Demonstrate the procedures for the accomplishment of the job sheets.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Edge Form Without Wall

      2. TM 2--Edge Form with Wall

      3. TM 3--Types of Pours Using Edge Forms

      4. TM 4--Types of Pours Using Edge Forms (Continued)

      5. TM 5--Types of Forms

      6. TM 6--Types of Forms (Continued)

   D. Job sheets

      1. Job Sheet #1--Construct Edge Forms for a Slab on Grade Without Foundation

      2. Job Sheet #2--Construct Edge Forms for a Slab on Grade with Foundation

      3. Job Sheet #3--Construct Edge Forms for a Patio

E. Test

F. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

B. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Cliffs: Prentice-Hall Inc., 1967.

C. Peurifoy, R. L. *Formwork for Concrete Structures.* New York: McGraw-Hill Book Company, 1964.

D. *Concrete Form Construction.* Albany, New York: Delmar Publications.

E. Hendrix, Laborn J. "Bud," and Patton, Bob. *Construction Craftsman's Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1978.

EDGE FORMS ON GRADE
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Edge form--Low form placed at the perimeter of a slab

   B. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure

   C. Duplex nail--Double-headed nail used in forming and designed for easy removal

   D. Foundation--That portion of a wall, including the footing, upon which the building rests

   E. Grade point--Level of the finished concrete in a form

   F. Monolithic pour--Continuous mass of concrete cast as a single unit

   G. Sheathing--Wood or metal that makes up the face of the form

   H. Stakes--Small boards or steel bars sharpened on one end and driven into the ground to help support a form

   I. Expansion joint--Preformed piece of fibrous or asphaltic material used to separate units of concrete to prevent cracking due to expansion

   J. Slab--Section of concrete larger in its horizontal dimensions than in thickness

   K. Screed--Guide for leveling the surface

   L. Scab--Piece of material nailed across a splice to strengthen and hold it together

   M. Dowel--Short piece of steel bar inserted through a bulkhead to tie adjoining pours together

   N. Plumb bob--Tool or device attached to a string; used to set and/or check the plumb or perpendicular of a surface

   O. Form tie--Wire or metal cross tie used to hold the pressure of wet concrete and maintain the proper wall thickness

II. Parts of an edge form (Transparencies 1 and 2)

   A. Stake

   B. Sheathing

INFORMATION SHEET

- C. Brace
- D. Scab
- E. Duplex nail
- F. Block
- G. Support
- H. Kicker
- I. Form tie

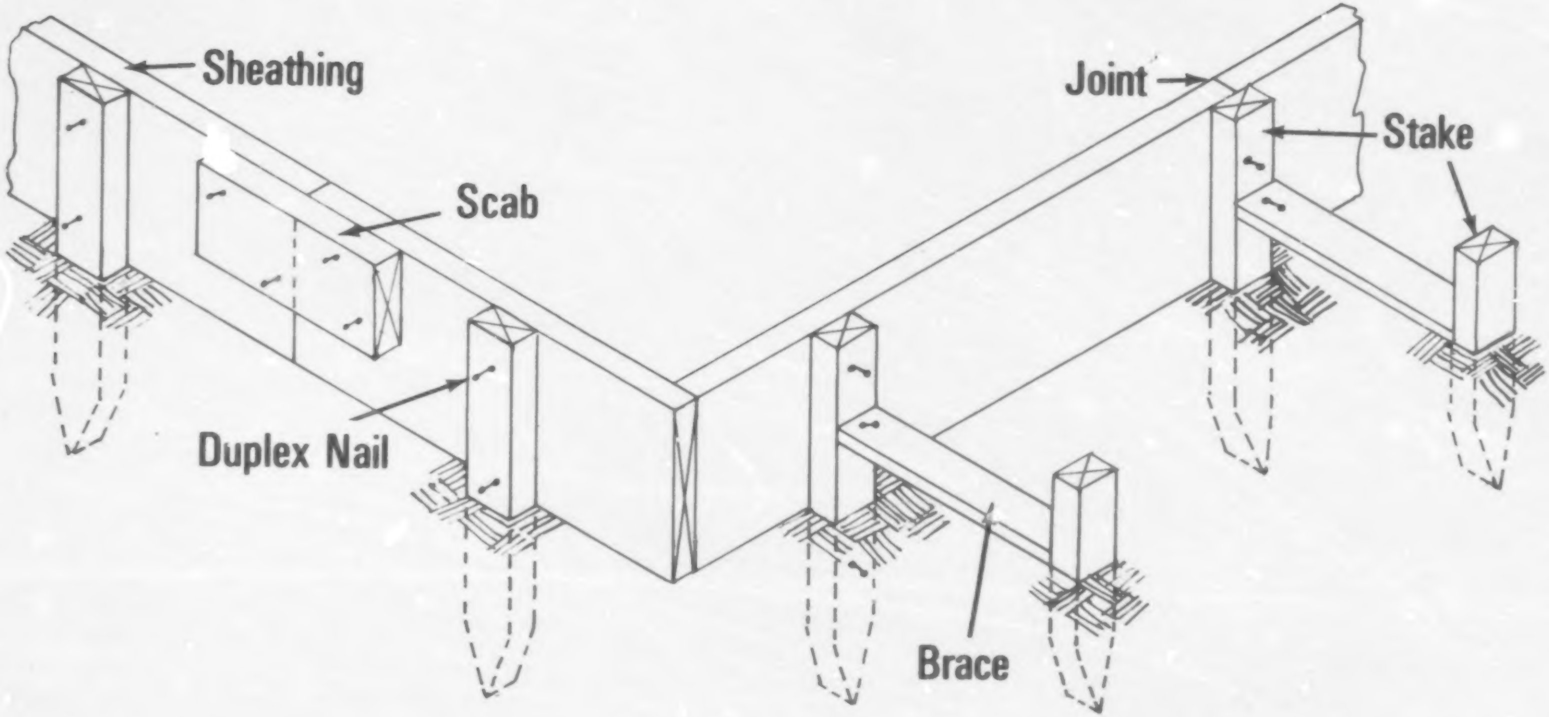
III. Types of pours using edge forms (Transparencies 3 and 4)

- A. Floor with foundation
- B. Floor without foundation
- C. Stoop
- D. Driveway
- E. Sidewalk
- F. Approach

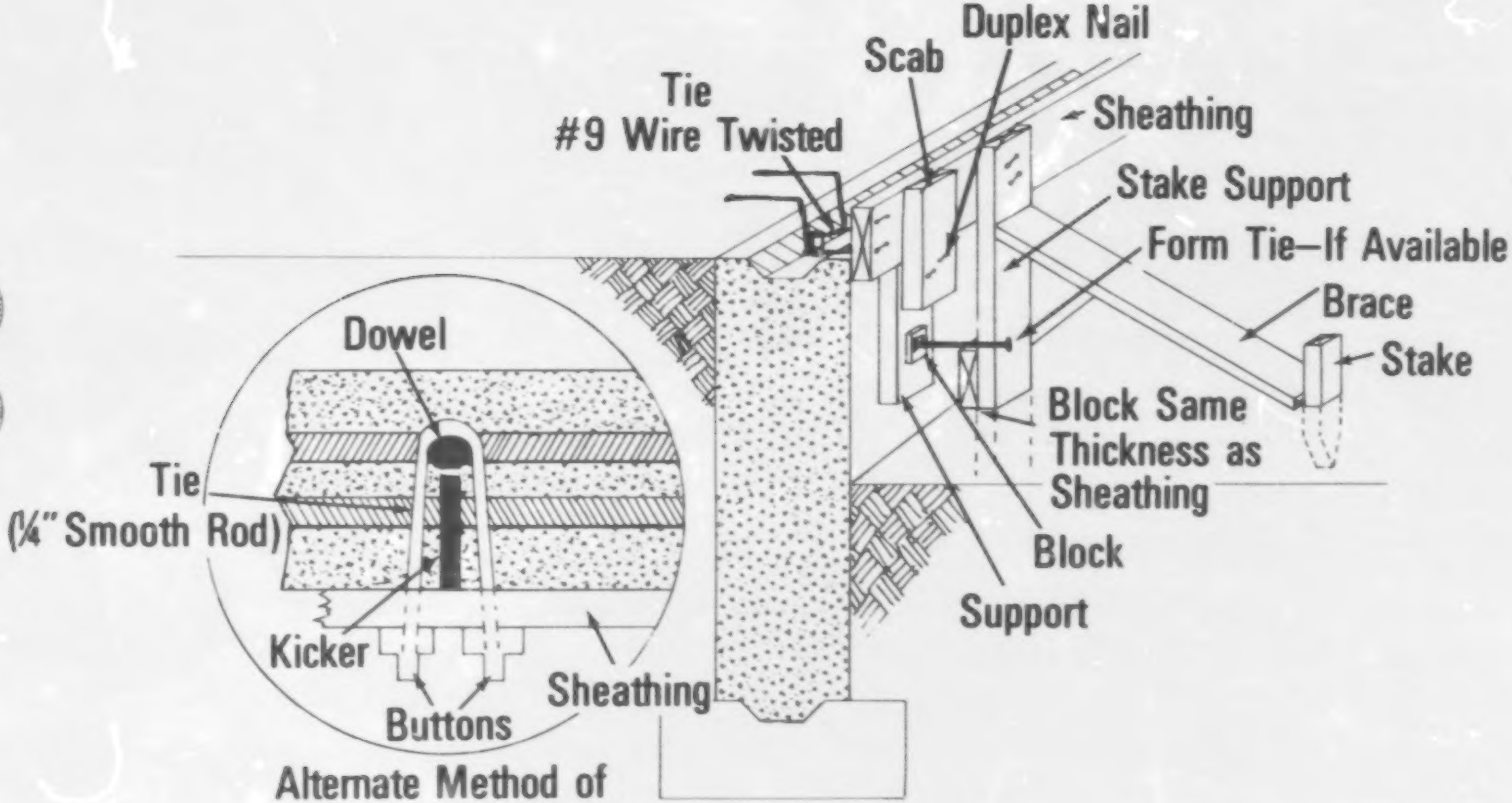
IV. Types of edge forms (Transparencies 5 and 6)

- A. Wood
- B. Metal
- C. Combination of wood and metal

Edge Form Without Wall

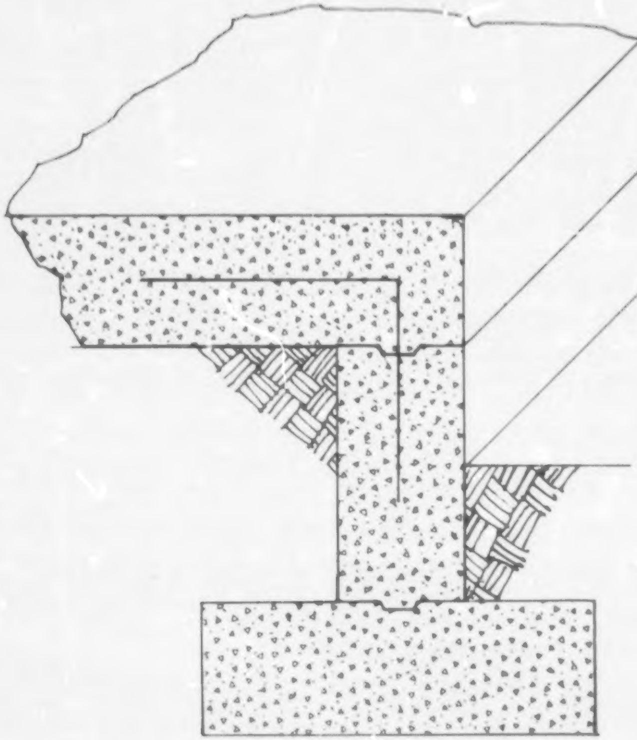

Sheathing
Joint
Stake
Scab
Stake
Duplex Nail
Brace

Edge Form With Wall

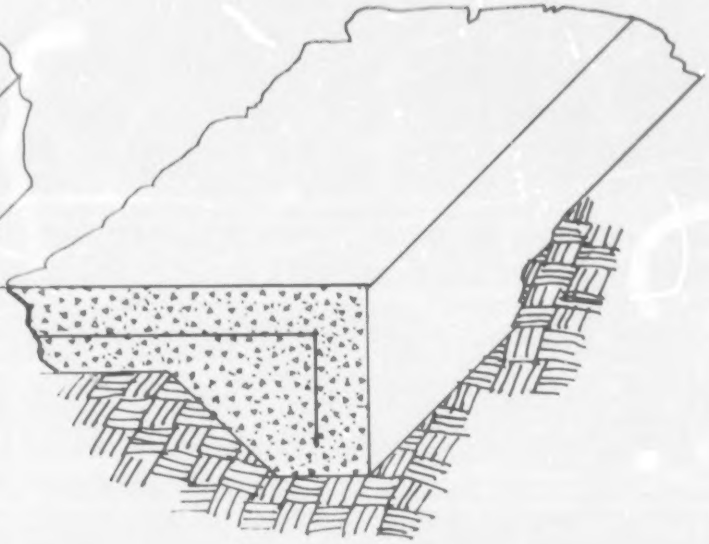

Duplex Nail
Scab
Tie
#9 Wire Twisted
Sheathing
Stake Support
Form Tie–If Available
Brace
Stake
Block Same Thickness as Sheathing
Block
Support
Dowel
Tie
(¼" Smooth Rod)
Kicker
Sheathing
Buttons

Alternate Method of Tieing Form to Wall

Types of Pours Using Edge Forms



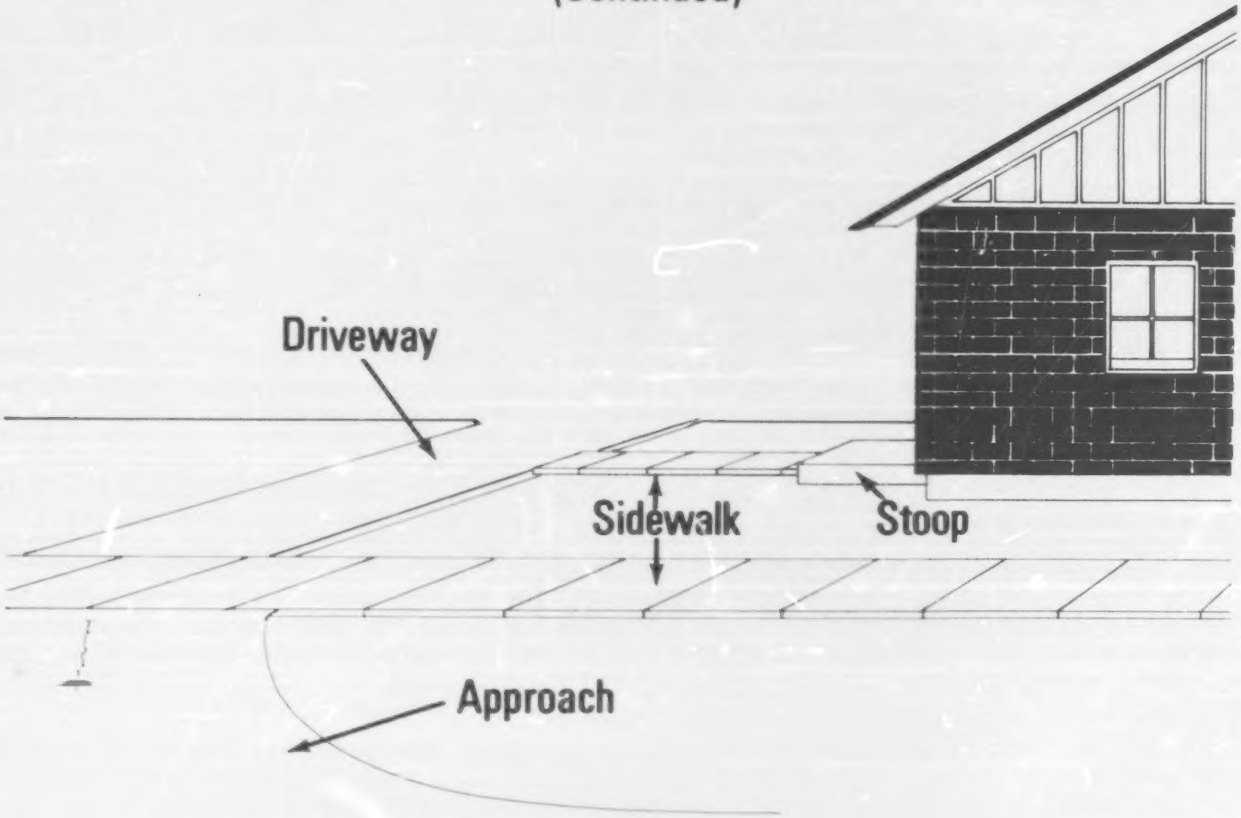
Floor With Foundation



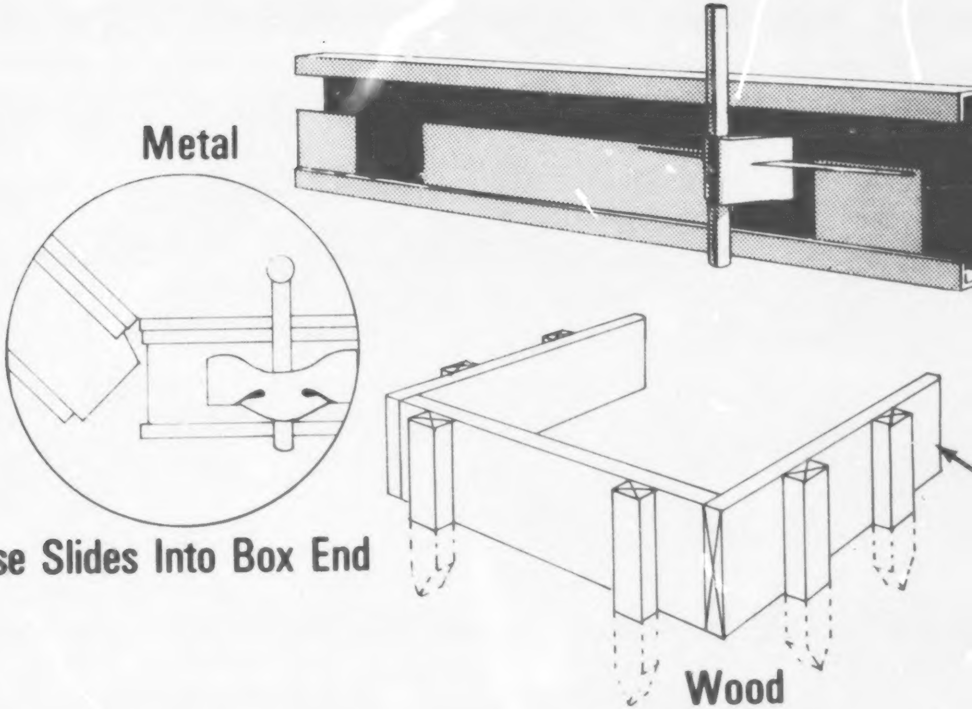
Floor Without Foundation

Types of Pours Using Edge Forms

(Continued)

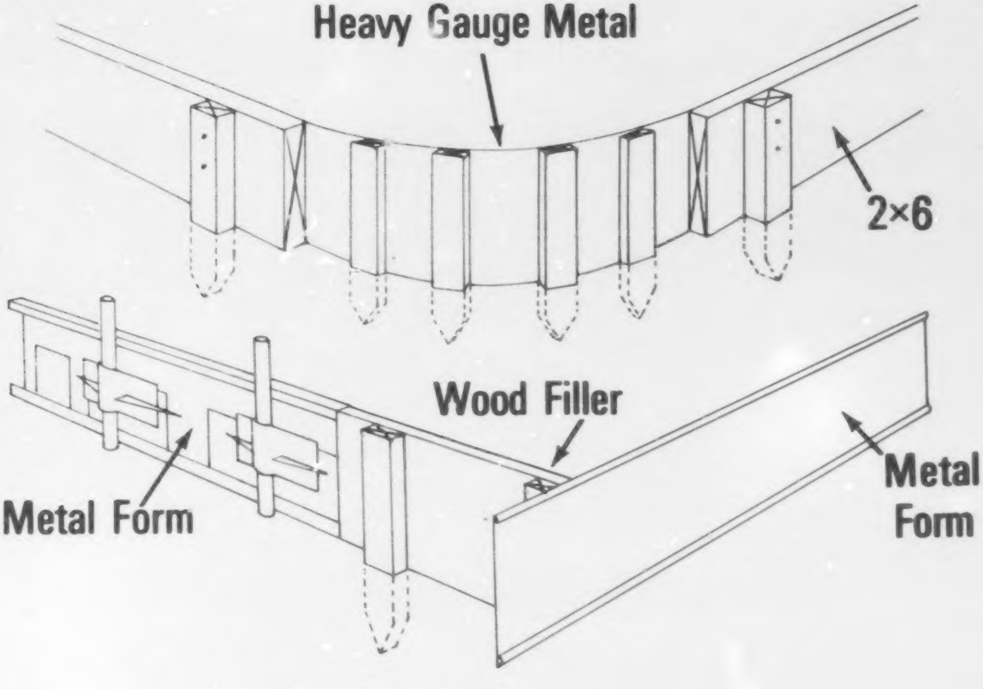

Driveway
Sidewalk
Stoop
Approach

Types of Forms


Metal
Nose Slides Into Box End
Wood

Types of Forms

(Continued)


Heavy Gauge Metal
2×6
Wood Filler
Metal Form
Metal Form

Combination Metal & Wood

TM 6

EDGE FORMS ON GRADE
UNIT III

JOB SHEET #1--CONSTRUCT EDGE FORMS FOR A SLAB ON GRADE WITH FOUNDATION

I. Tools and materials

A. Tools

1. Sledge hammer
2. Claw hammer, 16 ounce or larger
3. Electric handsaw
4. Crosscut handsaw
5. Tape measure, 100 foot
6. Tape measure, 12 or 16 foot
7. Level, hand
8. Chalkline and reel
9. Builder's level
10. Plumb bob

B. Materials

1. Stakes
2. 2 x 8's for sheathing
3. Nails
    a. 16d duplex
    b. 8d duplex

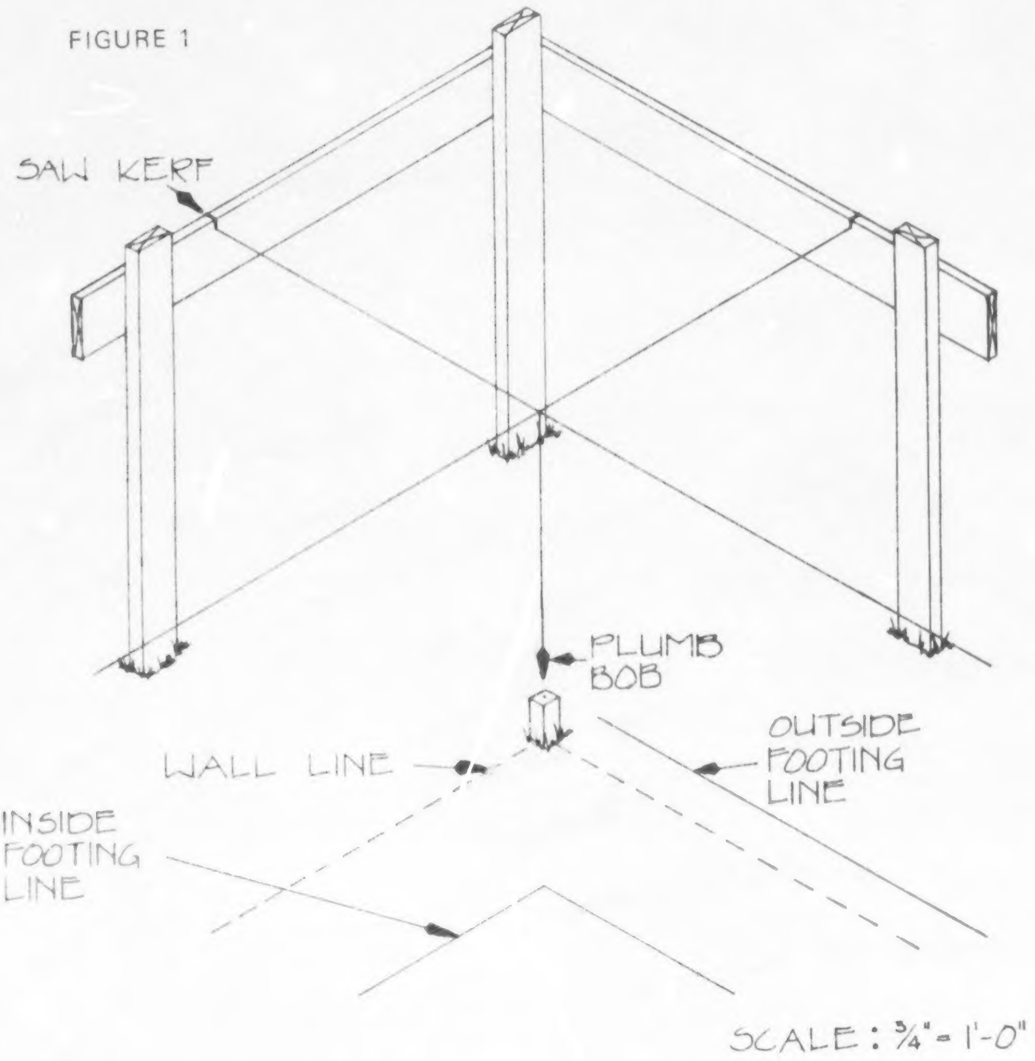
II. Procedure

A. Secure line to batter boards establishing four sides of the building

JOB SHEET #1

B. Attach plumb bob to line intersections (Figure 1)

FIGURE 1


SAW KERF
PLUMB BOB
WALL LINE
OUTSIDE FOOTING LINE
INSIDE FOOTING LINE
SCALE: ¾" = 1'-0"

C. Drive corner form stakes

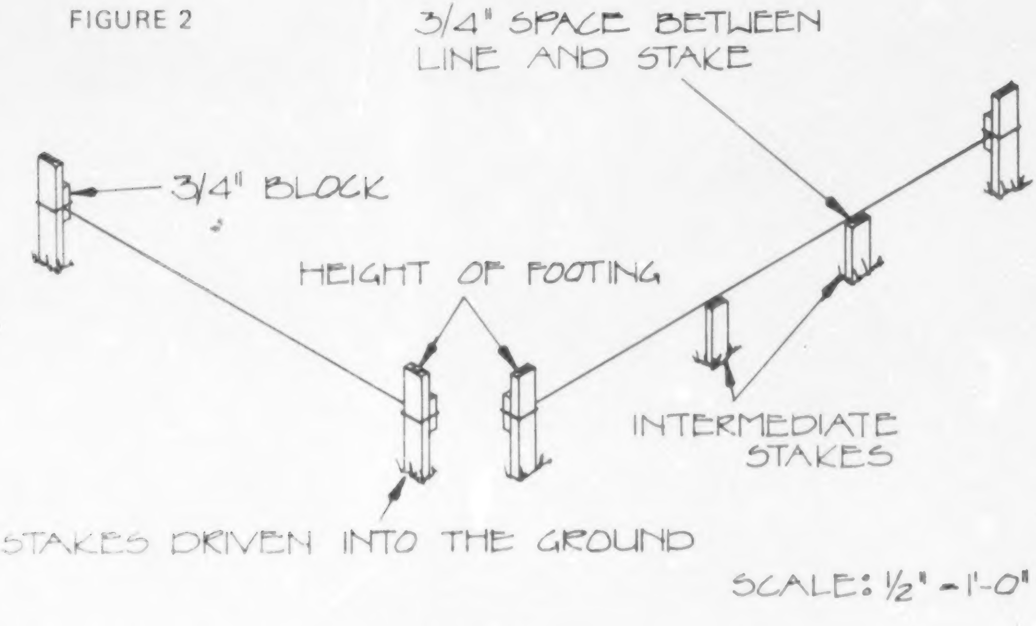
(NOTE: Drive stakes outside the wall corner the thickness of the slab. See Figure 1. Stakes should be long enough to reach below the edge thickness of the slab.)

D. Repeat steps B and C on the other three corners

JOB SHEET #1

E. Stretch a line between corner stakes and drive the intermediate stakes (Figure 2)

FIGURE 2


3/4" SPACE BETWEEN LINE AND STAKE
3/4" BLOCK
HEIGHT OF FOOTING
INTERMEDIATE STAKES
STAKES DRIVEN INTO THE GROUND

SCALE: 1/2" = 1'-0"

F. Establish the grade elevation on all corner stakes

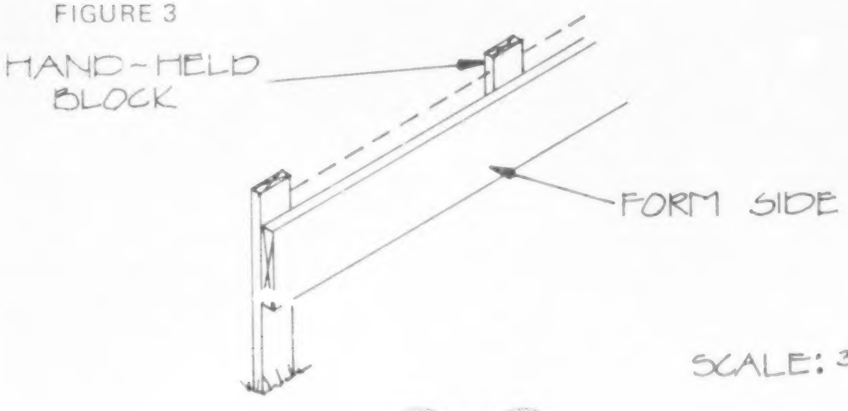
G. Secure a line 3/4" above mark to gauge height of sheathing

(NOTE: Material of any thickness may be used for a gauge block.)

H. Nail sheathing to stakes using a 3/4" gauge block (Figure 3)

(NOTE: Sight line to be sure it has not sagged.)

FIGURE 3

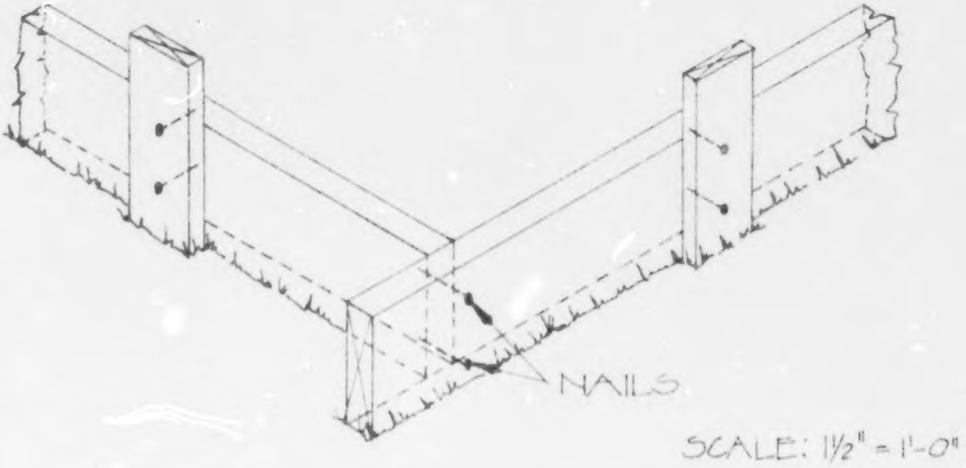

HAND-HELD BLOCK
FORM SIDE

SCALE: 3/4" = 1'-0"

JOB SHEET #1

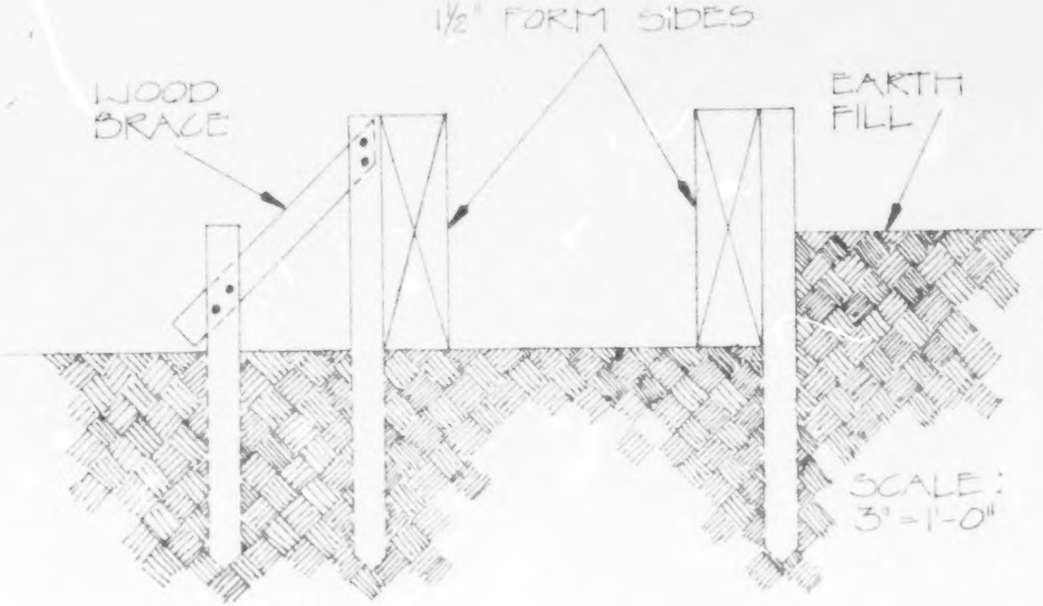
I. Tie all corners together as shown (Figure 4)

FIGURE 4


NAILS
SCALE: 1½" = 1'-0"

J. Brace the forms by one of the methods shown (Figure 5)

FIGURE 5


1½" FORM SIDES
WOOD BRACE
EARTH FILL
SCALE: 3" = 1'-0"

JOB SHEET #1

K. Make grade board as shown (Figures 6a and 6b)

(NOTE: On wide buildings, it will be necessary to set a temporary screed. See Figure 6b.)

FIGURE 6a

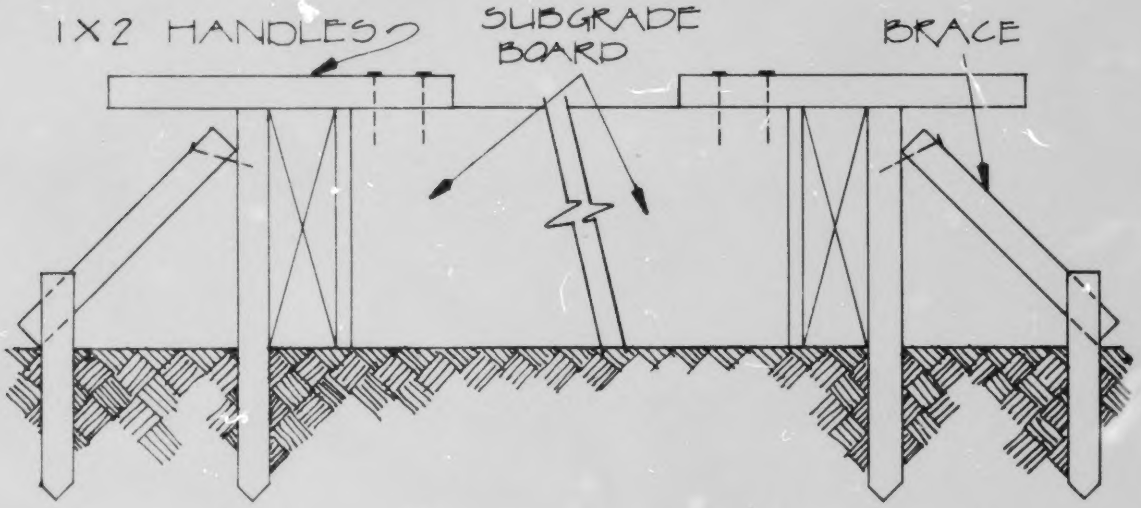
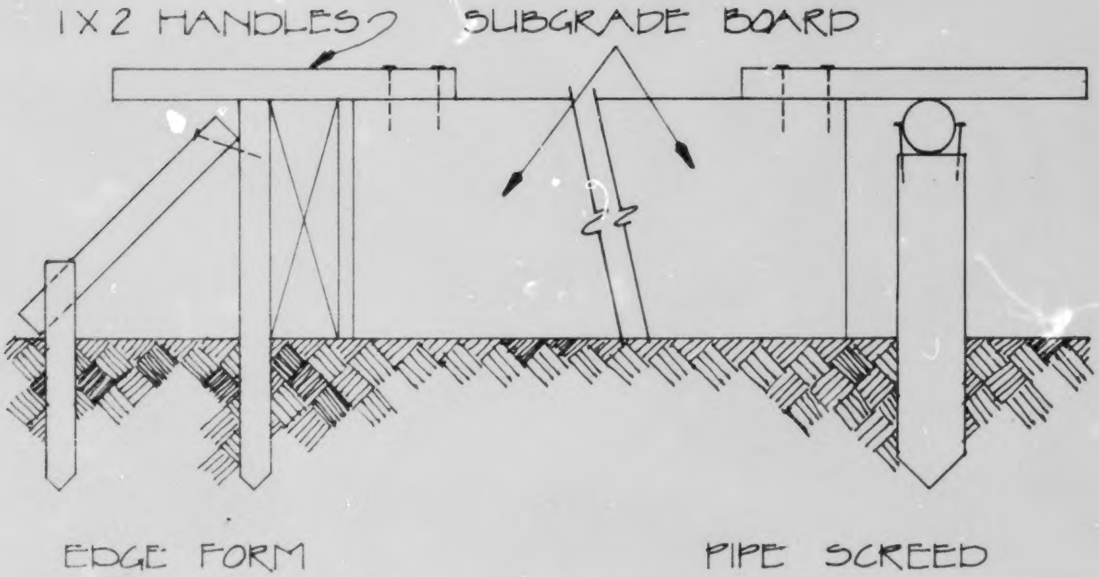

1X2 HANDLES
SUBGRADE BOARD
BRACE
SCALE: 3"=1'-0"

FIGURE 6b


1X2 HANDLES
SUBGRADE BOARD
EDGE FORM
PIPE SCREED

EDGE FORMS ON GRADE
UNIT III

JOB SHEET #2--CONSTRUCT EDGE FORMS FOR A SLAB ON GRADE WITH FOUNDATION

I. Tools and materials

A. Tools

1. Sledge hammer
2. Claw hammer, 16 ounce or larger
3. Electric handsaw
4. Crosscut handsaw
5. Tape measure, 100 foot
6. Tape measure, 12 or 16 foot
7. Level, hand
8. String line
9. Chalkline
10. Builder's level
11. Plumb bob

B. Materials

1. Stakes
2. Sheathing
3. Nails
    a. 16d duplex
    b. 8d duplex
4. Wire, #9 annealed
5. Dowels

II. Procedure

A. Lay sheathing on top of the wall or on the ground

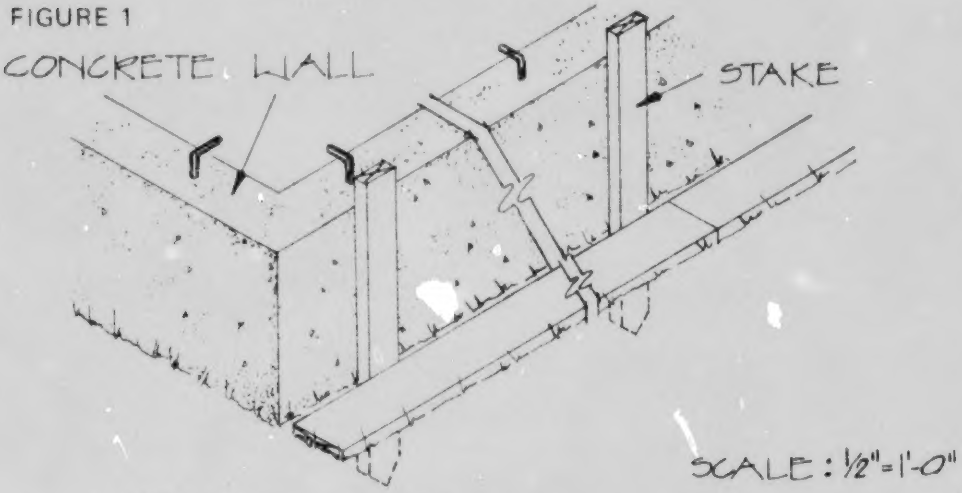
(NOTE: This is to establish location of support stakes.)

JOB SHEET #2

B. Drive support stakes at ends of each sheathing board (Figure 1)

(NOTE: Place a spacer block between the stake and the wall; hold the stake tightly against the spacer block while driving. When driven, the top of the stake should be above the finish slab grade.)

FIGURE 1



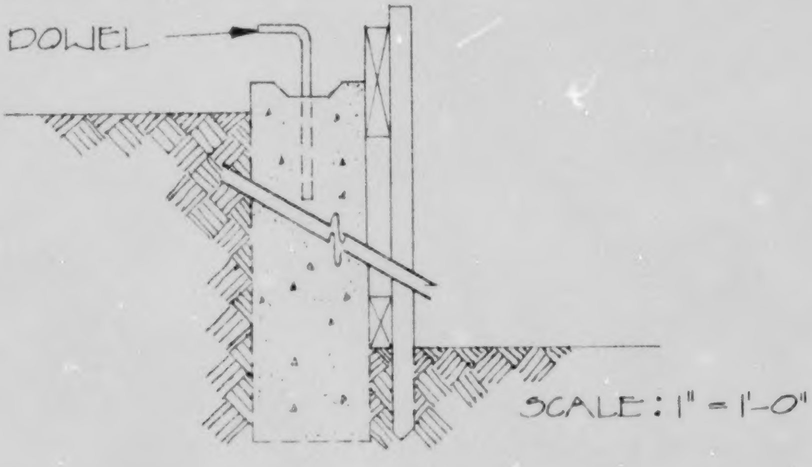
C. Establish grade on support stakes

(NOTE: Use the builder's level and establish the grade from the bench mark.)

D. Nail sheathing to stakes (Figure 2)

(NOTE: Drive a nail on the inside of the sheathing, a little less than the height of the grade mark on the stake and the foundation. Set sheathing in position, raise sheathing to grade mark, and nail.)

FIGURE 2



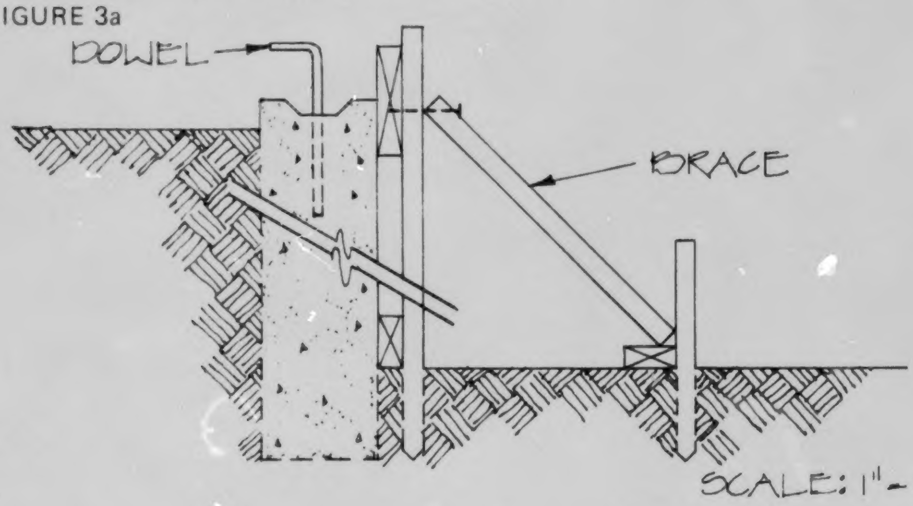
JOB SHEET #2

E. Drive intermediate stakes

F. Secure sheathing tightly against the wall (Figures 3a and 3b)

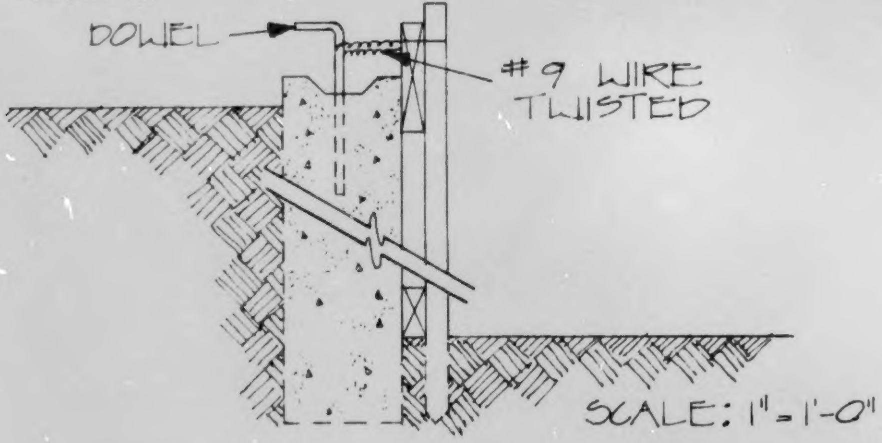
(NOTE: Figures 3a and 3b show alternate methods of holding the form against the wall and plumb. There could be situations where they would both be used on the same form.)

FIGURE 3a


DOWEL
BRACE
SCALE: 1" - 1'-0"

BRACE METHOD

FIGURE 3b


DOWEL
#9 WIRE TWISTED
SCALE: 1" = 1'-0"

TIE METHOD

G. Cut stakes off flush with top of the edge form on surfaces where straight edge will be pulled

EDGE FORMS ON GRADE
UNIT III

JOB SHEET #3--CONSTRUCT EDGE FORMS FOR A PATIO

I. Tools and materials

A. Tools

1. Sledge hammer
2. Claw hammer, 16 ounce or larger
3. Electric handsaw
4. Crosscut handsaw
5. Tape measure, 100 foot
6. Tape measure, 12 or 16 foot
7. Level, hand
8. Chalkline and reel
9. Builder's level

B. Materials

1. Stakes
2. 2 x 6's and hard board for radius
3. Nails
    a. 6d box
    b. 8d duplex

II. Procedure

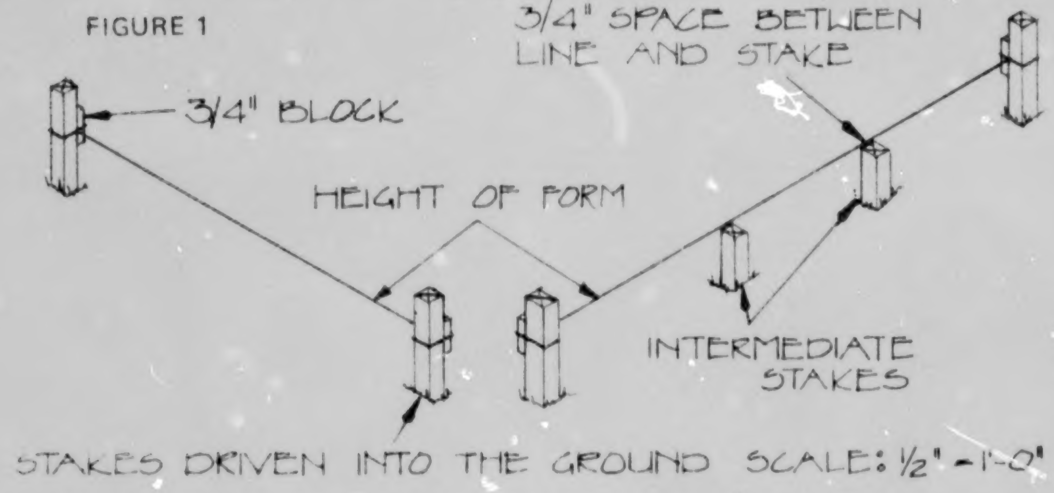
A. Establish a grade line using the builder's level

(NOTE: Patios should slope from the building.)

JOB SHEET #3

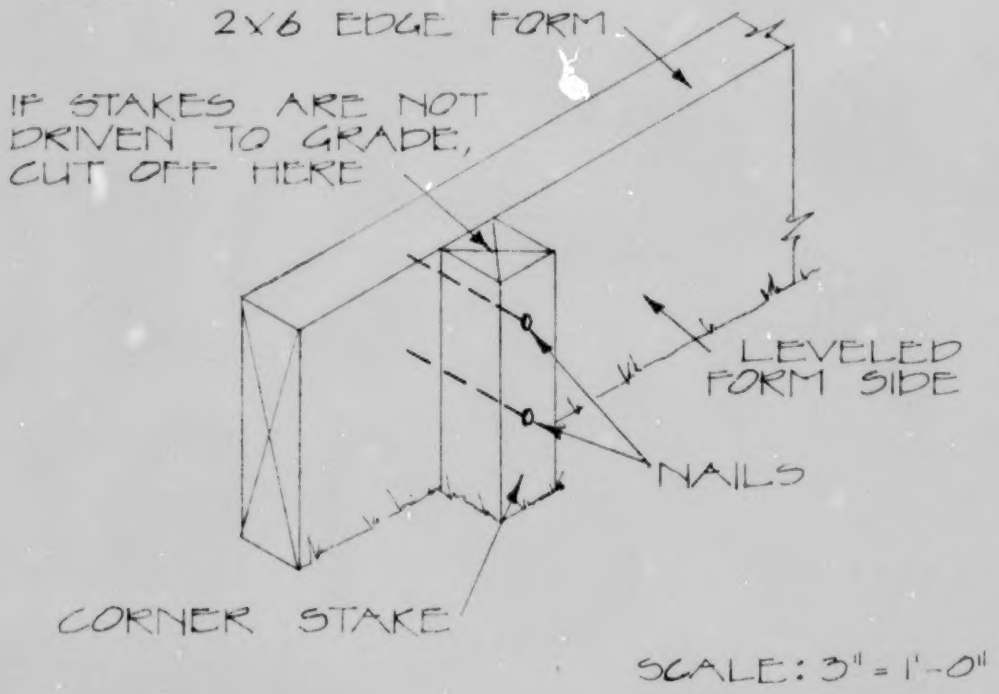
B. Drive corner and radius stakes, stretch a line between corner stakes, and drive the intermediate stakes (Figure 1)

FIGURE 1


3/4" SPACE BETWEEN LINE AND STAKE
3/4" BLOCK
HEIGHT OF FORM
INTERMEDIATE STAKES
STAKES DRIVEN INTO THE GROUND
SCALE: ½" = 1'-0"

C. Nail 2 x 6's to stakes (Figure 2)

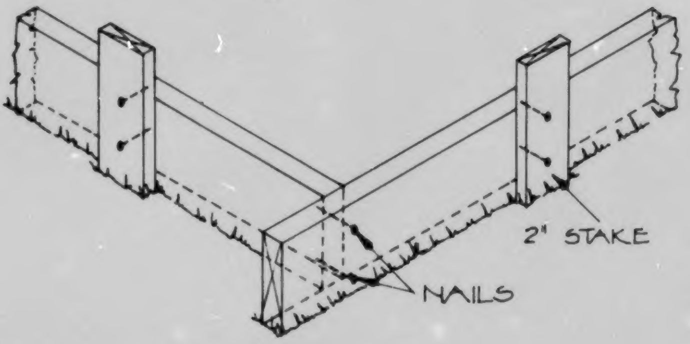
FIGURE 2


2X6 EDGE FORM
IF STAKES ARE NOT DRIVEN TO GRADE, CUT OFF HERE
LEVELED FORM SIDE
NAILS
CORNER STAKE
SCALE: 3" = 1'-0"

JOB SHEET #3

D. Tie the corners together as illustrated (Figure 3)

FIGURE 3

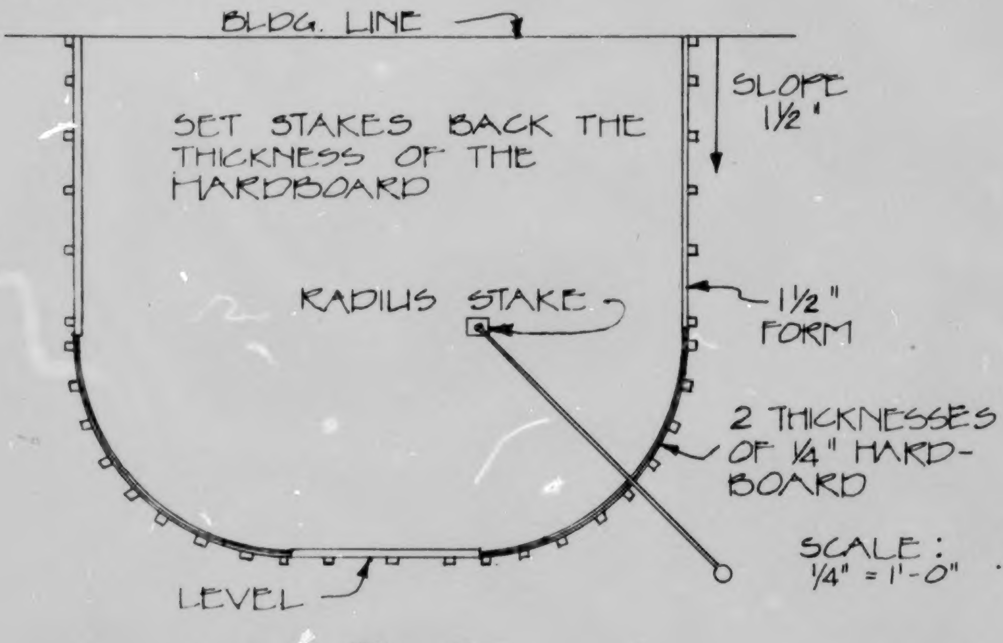

2" STAKE
NAILS

E. Set forms for curved sections (Figure 4)

1. Cut 1/4" hardboard into strips the thickness of the concrete
2. Hook tape on nail in radius stake
3. Drive stakes on radius line (Figure 4)

   (NOTE: Set stake back the thickness of the hardboard. With this radius, use two thicknesses, 1/2" with staggered joints.)

FIGURE 4


BLDG. LINE
SLOPE 1½"
SET STAKES BACK THE THICKNESS OF THE HARDBOARD
RADIUS STAKE
1½" FORM
2 THICKNESSES OF ¼" HARD-BOARD
SCALE: ¼" = 1'-0"
LEVEL

JOB SHEET #3

4. Nail hardboard to stakes

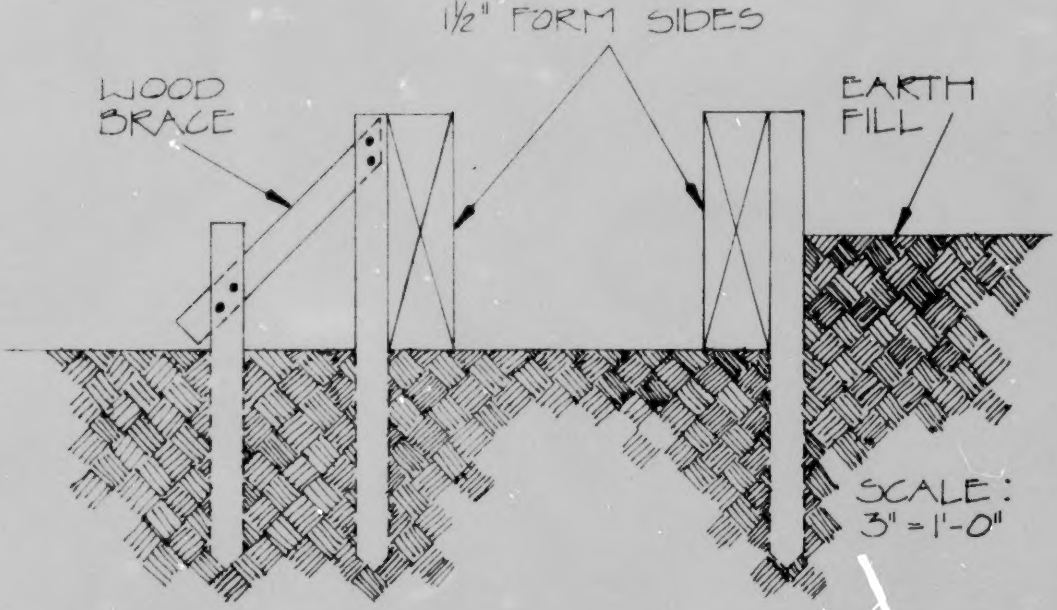
   a. Hold the two pieces of hardboard flush on top and start nailing at one end

   b. Proceed to add pieces and nail to stakes until curve is complete

   (NOTE: If joints miss stakes, drive another stake.)

F. Brace the forms by one of the methods shown (Figure 5)

FIGURE 5


1½" FORM SIDES
WOOD BRACE
EARTH FILL
SCALE: 3" = 1'-0"

EDGE FORMS ON GRADE
UNIT III

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Low form placed at the perimeter of a slab

_____b. Piece of wood or other material that directs, resists, or supports weight or pressure

_____c. Level of the finished concrete in a form

_____d. Continuous mass of concrete cast as a single unit

_____e. Wood or metal that makes up the face of the form

_____f. Preformed piece of fibrous or asphaltic material used to separate units of concrete to prevent cracking due to expansion

_____g. Guide for leveling the surface

_____h. Section of concrete larger in its horizontal dimensions than in thickness

_____i. Double-headed nail used in forming and designed for easy removal

_____j. That portion of a wall, including the footing, upon which the building rests

_____k. Small boards or steel bars sharpened on one end and driven into the ground to help support a form

_____l. Short piece of steel bar inserted through a bulkhead to tie adjoining pours together

_____m. Piece of material nailed across a splice to strengthen and hold it together

1. Sheathing
2. Brace
3. Duplex nail
4. Expansion joint
5. Monolithic pour
6. Foundation
7. Edge form
8. Grade point
9. Screed
10. Slab
11. Stakes
12. Scab
13. Plumb bob
14. Form tie
15. Dowel

______n. Tool or device attached to a string; used to set and/or check the plumb or perpendicular of a surface

______o. Wire or metal cross tie used to hold the pressure of wet concrete and maintain the proper wall thickness

2. Identify the parts of an edge form by placing the correct numbers in the corresponding blanks.

______a. Stake

______b. Sheathing

______c. Brace

______d. Scab

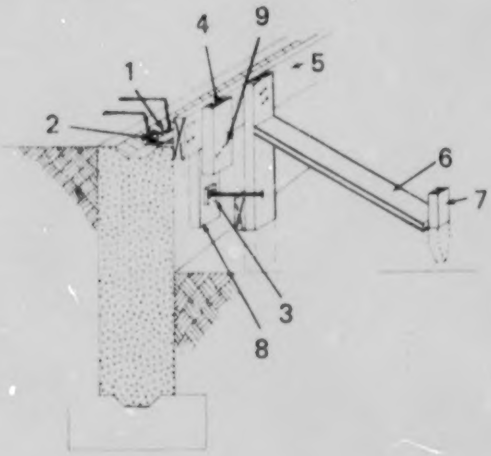
______e. Duplex nail

______f. Block

______g. Support

______h. Kicker

______i. Form tie



3. Name types of pours using edge forms.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

4. Name types of edge forms.

a. ______________________________

b. ______________________________

c. ______________________________

5. Demonstrate the ability to:

   a. Construct edge forms for a slab on grade without foundation.

   b. Construct edge forms for a slab on grade with foundation.

   c. Construct edge forms for a patio.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

EDGE FORMS ON GRADE
UNIT III

ANSWERS TO TEST

1. a. 7
   b. 2
   c. 8
   d. 5
   e. 1
   f. 4
   g. 9
   h. 10
   i. 3
   j. 6
   k. 11
   l. 15
   m. 12
   n. 13
   o. 14

2. a. 7
   b. 5
   c. 6
   d. 4
   e. 9
   f. 3
   g. 8
   h. 2
   i. 1

3. a. Floor with foundation
   b. Floor without foundation
   c. Stoop
   d. Driveway
   e. Sidewalk
   f. Approach

4. a. Wood
   b. Metal
   c. Combination of wood and metal

5. Performance skills evaluated to the satisfaction of the instructor

WALL FORMS
UNIT IV

UNIT OBJECTIVE

After completion of this unit, the student should be able to determine the width and quantity of panels needed to complete a form. The student should be able to name the types of material used to build forms and the types of forms built from the materials. The student should also be able to list the advantages of gang and panel forms over built-in-place or erected-in-place forms and to list the reasons built-in-place or erected-in-place forms might be used. The student should also be able to construct various types of forms for walls. This knowledge will be evidenced by completion of assignment sheets, job sheets, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with wall forms to the correct definitions.
2. Identify the parts of a form.
3. Estimate the material needed to build a form.
4. Estimate the width of panels and the required number of each.
5. Name materials used to construct forms.
6. Name types of forms constructed.
7. List advantages of gang and panel forms over built-in-place or erected-in-place forms.
8. List reasons built-in-place or erected-in-place forms might be used.
9. Demonstrate the ability to:
    a. Construct straight wall with patented forms.
    b. Construct gang forms for a battered wall.
    c. Construct circular wall forms built in place.
    d. Construct panel forms.
    e. Construct slip forms.
    f. Remove forms and prepare for storage.

WALL FORMS
UNIT IV

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Parts of a Form

      2. TM 2--Plan of Foundation

      3. TM 3--Section A of Foundation Plan

      4. TM 4--Section B of Foundation Plan

      5. TM 5--Typical Pilaster Form

      6. TM 6--Panel Layout and Sizes

      7. TM 7--Patented Form Panels

      8. TM 8--Job-Built Panel Form

      9. TM 9--Built-in-Place Wood Form

      10. TM 10--Erected-in-Place Patented Form

      11. TM 11--Gang Forms

      12. TM 12--Plate Girder Forms

D. Assignment sheets

  1. Assignment Sheet #1--Material Estimating

  2. Assignment Sheet #2--Estimate Width and Number of Panels

E. Answers to assignment sheets

F. Job sheets

  1. Job Sheet #1--Construct Straight Wall with Patented Forms

  2. Job Sheet #2--Construct Gang Forms for a Battered Wall

  3. Job Sheet #3--Construct Circular Wall Forms Built in Place

  4. Job Sheet #4--Construct Panel Forms

  5. Job Sheet #5--Construct Slip Forms

  6. Job Sheet #6--Remove Forms and Prepare for Storage

G. Test

H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

B. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970.

C. Peurifoy, R. L. *Formwork for Concrete Structures.* New York: McGraw-Hill, Inc., 1964.

D. *Concrete Form Construction.* Albany, New York: Delmar Publications.

WALL FORMS
UNIT IV

INFORMATION SHEET

I. Terms and definitions

- A. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure
- B. Cleat--Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie
- C. Duplex nail--Double-headed nail used in forming and designed for easy removal
- D. Footing--Enlarged area at the base of a wall or other object to distribute the weight of the superstructure
- E. Form tie--Wire or metal cross tie used to hold the pressure of wet concrete and maintain the proper wall thickness
- F. Foundation--That portion of a wall upon which the structure rests
- G. Grade point--Level of the finished concrete in a form
- H. Key--Beveled piece of wood or metal placed in a form where future pours occur
- I. Key way--Groove left in the concrete by removal of the key
- J. Monolithic pour--Continuous mass of concrete cast as a single unit
- K. Scab--Piece of material nailed across a splice to strengthen and hold the two pieces together
- L. Sheathing--Wide boards, plywood, or metal that make up the face of the form
- M. Spreader--Piece of wood that is used to hold the sides of the form apart and is removed as the concrete is poured; may also be an integral part of the form tie
- N. Spacer block--Block of wood or other material used as a spacer at offsets in form
- O. Stakes--Small boards or steel bars sharpened at one end and driven into the ground to support the form
- P. Dowel--Short piece of steel bar used to tie adjoining pours together
- Q. Bulkhead--Board placed in a form to cut off the concrete pour
- R. Form oil--Paraffin oil or other manufactured product used on forms to prevent adhesion of the concrete to the form

INFORMATION SHEET

S. Panel--Single section of patented or job-built forms

T. Pilaster--Upright architectural member treated as a column; usually projects a third or less of its width from the wall

U. Plumb bob--Tool or device attached to a string; used to set and/or check the plumb or perpendicular of a surface

V. Truss--Combination of members arranged in units to form a rigid framework for supporting loads over long spans

W. Yoke--Part of a structural assembly for slipforming which keeps the forms from spreading and transfers form load to the jack

X. Waler--Horizontal brace used in form construction

Y. Toe boards--Bottom safety rails on a scaffold

Z. Webs--Cross members of a truss

AA. Rebars (reinforcing bars)--Steel bars used to reinforce concrete which must sustain bending, stretching, or twisting forces

II. Parts of a form (Transparency 1)

A. Sheathing

B. Brace

C. Stake

D. Spreader

E. Cleat

F. Form tie

G. Waler

H. Stud

I. Strongback

J. Sole plate

K. Bottom plate

L. Top plate

M. Spreader washer

N. Scab

INFORMATION SHEET

O. Key

P. Bulkhead

Q. Spacer block

III. Material estimating (Assignment Sheet #1)

A. Studs

1. Determine length needed from height of wall

2. Determine number needed

a. For 16" on center

1) Multiply the length of the form by three-fourths

2) Add one stud for each corner and one for each panel

3) Add four studs for each pilaster

(CAUTION: Figure two sides of forms.)

b. For 2' on center

1) Multiply the length of the form by one-half

2) Add one stud for each corner, one for each panel, and four for each pilaster

B. Sheathing

1. Plywood--Square feet or number of pieces

(NOTE: Either 3/4" x 4' x 8' or 3/4" x 4' x 12' may be used.)

a. Calculate the square foot area

b. For 4' x 8' plywood, divide the square foot areas by thirty-two and round up to the next whole number to determine number of pieces

c. For 4' x 12' plywood, divide the square foot area by forty-eight and round up to the next whole number to determine number of pieces

INFORMATION SHEET

2. Lumber--Board feet

   a. Calculate the square foot area of the forms

   b. Calculate the material that must be allowed for waste by using the following table; add to the square foot area

Material	Percentage
1 x 6 - Tongued and Grooved	20
1 x 8 - Tongued and Grooved	15
1 x 6 - Square Edge	12
1 x 8 - Square Edge	10

C. Plates (2 x 4 or 2 x 6)

(NOTE: Plate material is usually ordered in sixteen-foot lengths.)

1. Determine length of forms

2. Multiply the length by four

   (NOTE: If a sole plate is used, multiply by six.)

3. Divide the total lineal footage by 16 to get the number of pieces needed

D. Walers

(NOTE: Waler material is usually ordered in sixteen-foot lengths.)

1. Calculate the number of walers by using the following table

50° Temperature					For 3/4" Sheathing, 2x4 Studs, Double 2x6 Walers	70° Temperature				
2"	3"	4"	5"	6"	Rate of Pour (Vertical Feet Per Hour)	2"	3"	4"	5"	6"
21"	18"	18"	16"	15"	Stud spacing for safe value of sheathing	24"	21"	18"	18"	18"
30"	27"	24"	24"	24"	Waler spacing for safe value of studs	33"	30"	27"	27"	24"
48"	42"	39"	33"	27"	Tie spacing for safe value of walers	48"	48"	45"	39"	39"

5000# TIES.

(NOTE: Wall height divided by waler spacing equals the number of walers.)

INFORMATION SHEET

2. Determine the total length of the forms (inside and outside)

3. Multiply the total length of the forms by two

4. Multiply by the number of walers

5. Add two feet for each pilaster

   (NOTE: This is lineal feet of material needed.)

6. Divide the total lineal feet by sixteen to get the total number of pieces needed

E. Waler spacer blocks and supports--Lineal feet

(NOTE: Spacer blocks and supports are usually 1 x 4 material, spaced four feet on center.)

1. Divide the total lineal feet of waler material by two

2. Divide by four to get the number of lineal feet of 1 x 4's needed

   (NOTE: One lineal foot of 1 x 4 will cut one spacer 3 1/2" long and one support 8 1/2" long.)

F. Braces--Number and length (2 x 4's - 16')

(NOTE: Braces are normally only used on one side of a form.)

1. Determine length of brace

   (NOTE: Brace should be not less than a forty-five degree angle to the form.)

2. Determine length of form to be braced

3. Divide by the brace spacing to get the number of braces needed; add one brace for end

G. Stakes--Lineal feet or ready-made, one for each brace

(NOTE: Length will be determined by soil conditions.)

H. Form ties

(NOTE: Form ties are ordered by quantity needed. Give breaking strength; stud, sheathing, and waler width; and wall thickness.)

INFORMATION SHEET

1. Determine the tie spacing by using the following table

50° Temperature					For 3/4" Sheathing, 2x4 Studs, Double 2x6 Walers	70° Temperature				
2"	3"	4"	5"	6"	Rate of Pour (Vertical Feet Per Hour)	2"	3"	4"	5"	6"
21"	18"	18"	16"	15"	Stud spacing for safe value of sheathing	24"	21"	18"	18"	18"
30"	27"	24"	24"	24"	Waler spacing for safe value of studs	33"	30"	27"	27"	24"
48"	42"	39"	33"	27"	Tie spacing for safe value of walers	48"	48"	45"	39"	39"

5000# TIES

2. Determine the length of the form

3. Divide by the tie spacing to determine the number of ties per horizontal row

4. Multiply by the number of walers, as determined in D-1, for the total number of ties needed

I. Form tie clamps--Multiply the number of ties by two

IV. Estimating width and number of panels (Assignment Sheet #2)

A. Determine panel sizes by

1. Ability to handle at the building and erection site

2. Plan dimensions

3. Cutting materials with the least amount of waste

B. Determine sections of wall that will take identical panels (Transparency 2)

1. Pilaster spacing, north and south walls

2. East and west walls and the returns to the first pilaster

C. Determine panel sizes for section A (Transparency 3)

1. Main panels sixteen feet long

(NOTE: Form plywood can be purchased in 4' x 8' or 4' x 12' sheets. Either of these sizes would build a 16' long panel without waste. Panels could be 4', 8', or 16' wide.)

2. Filler panel sizes determined by distance between pilasters minus the thickness of the sheathing on the pilaster form

INFORMATION SHEET

3. Location of inside panels

    a. Tie holes in panel a must line up with tie holes in panel b

    b. Panel a will be 3/4" to the right of the left side of the pilaster

D. Determine panel sizes for section B (Transparency 4)

1. Inside end wall will be made up of three panels, one main panel, and two fillers

    (NOTE: Two 16' main panels can not be used because of tie spacing.)

2. Main panel will be located to line up with tie holes in outside panel k or m

3. Filler panel sizes will be 9'-0 3/4" for panel a and 6'-11 1/4" for panel b

    (NOTE: These two panels total 16' and can be built without waste by using the salvage from the first panel to build the second.)

$$\begin{array}{lr} & 16'\text{-}0'' \\ & -\ 6'\text{-}11\ 1/4'' \\ \hline \text{Panel a} & 9'\text{-}0\ \ 3/4'' \end{array}$$

$$\begin{array}{lr} & 16'\text{-}0'' \\ & -\ 9'\text{-}0\ 3/4'' \\ \hline \text{Panel b} & 6'\text{-}11\ 1/4'' \end{array}$$

4. Panel c will be 13'-8 1/2"

$$\begin{array}{r} 15'\text{-}0'' \\ -\ 0\text{-}11\ 1/4'' \\ \hline 14'\text{-}\ 0\ 3/4'' \\ -\ \ \ 4\ 1/4'' \\ \hline 13'\text{-}\ 8\ 1/2'' \end{array}$$

5. Panel d will be 15'-7"

$$\begin{array}{r} 15'\text{-}11\ 1/4'' \\ -\ \ \ 4\ 1/4'' \\ \hline 15'\text{-}\ 7'' \end{array}$$

(NOTE: Panels c and e will be the same size as panels d and f.)

INFORMATION SHEET

6. Panel g

   a. Stud frame, 15'-3 1/2"

      15'-0"
      + 4 1/4"
      15'-4 1/4"
      - 3/4"
      15'-3 1/2"

   b. Sheathing, 14'-11 1/4"

      15'- 3 1/2"
      - 4 1/4"
      14'-11 1/4"

   (NOTE: Panels g, h, i, and j will all be the same size. Make h and i left-hand panels and g and j right-hand panels.)

E. Pilaster panels for sections A and B (Transparency 5)

1. Side panels will be 1'-0"

   (NOTE: This will be sheathing only.)

2. Face panel will be 2'-8 1/2"

2'-0"	4 1/4"
+ 8 1/2"	+ 4 1/4"
2'-8 1/2"	8 1/2"

F. Quantity of panels of each side needed to erect the foundation forms (Transparencies 5 and 6)

1. 18--16'-0"
2. 4--13'-10 1/2"
3. 2--15'-3 1/2" R
4. 2--15'-3 1/2" L
5. 2--13'-8 1/2" L
6. 2--15'-7" R
7. 2--9'-0 3/4" L
8. 2--6'-11 1/4" R

INFORMATION SHEET

   9. 8--2'-8 1/2"

   10. 16--1'-0" sheathing only

V. Materials used to construct forms

   A. Wood

   B. Steel

   C. Fiberglass

   D. Combination of wood and metal

VI. Types of forms constructed (Transparencies 7, 8, 9, 10, 11 and 12)

   A. Panel

      1. Patented

      2. Job-built

   B. Built-in-place wood

   C. Erected-in-place patented

   D. Gang

      1. Job-built wood

      2. Patented panel

   E. Plate girder

VII. Advantages of gang and panel forms over built-in-place or erected-in-place forms

   A. Faster erection

   B. Faster stripping

   C. More reuses of form material

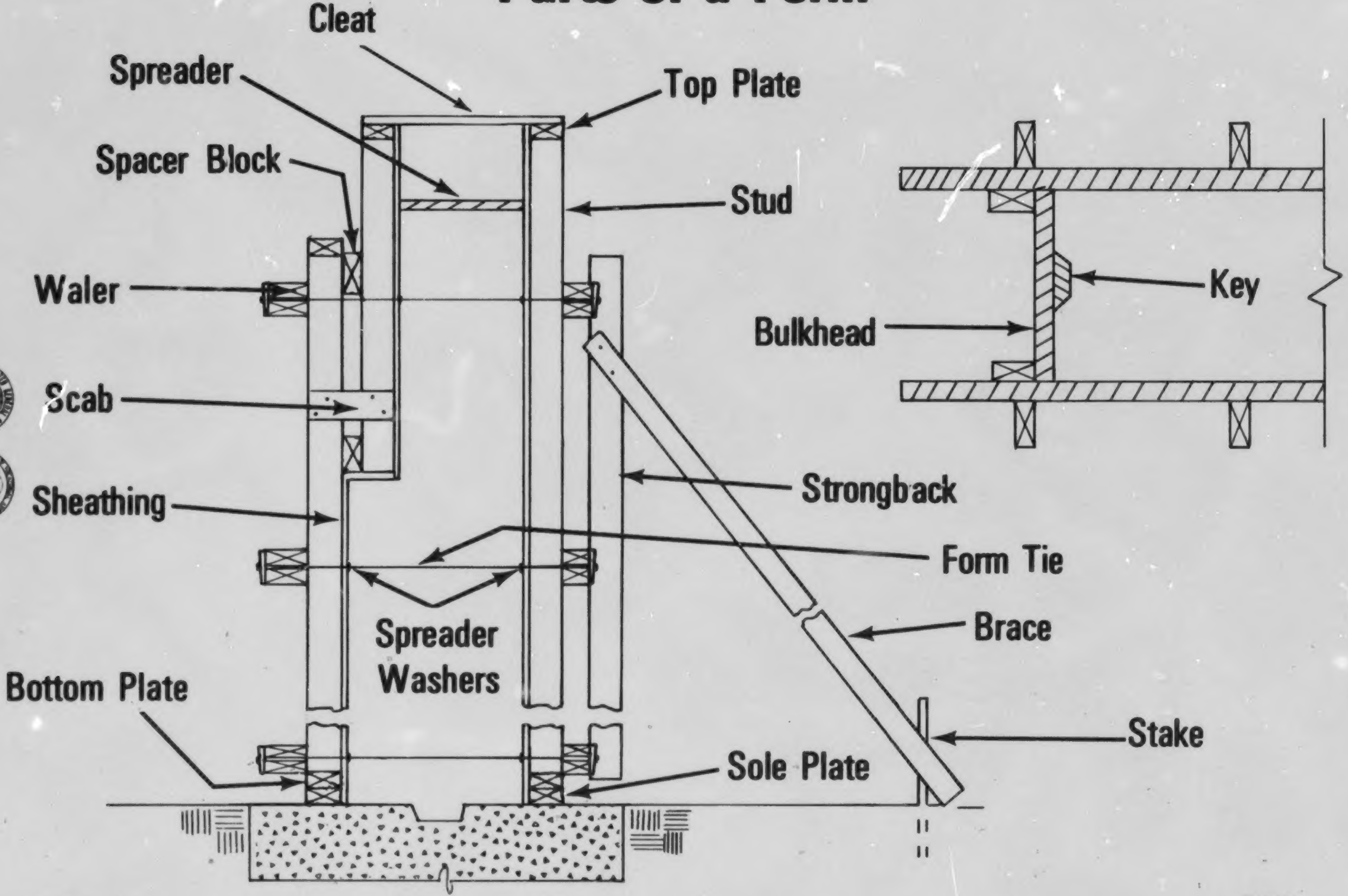
   D. Cleaner site

VIII. Reasons why built-in-place or erected-in-place forms might be used

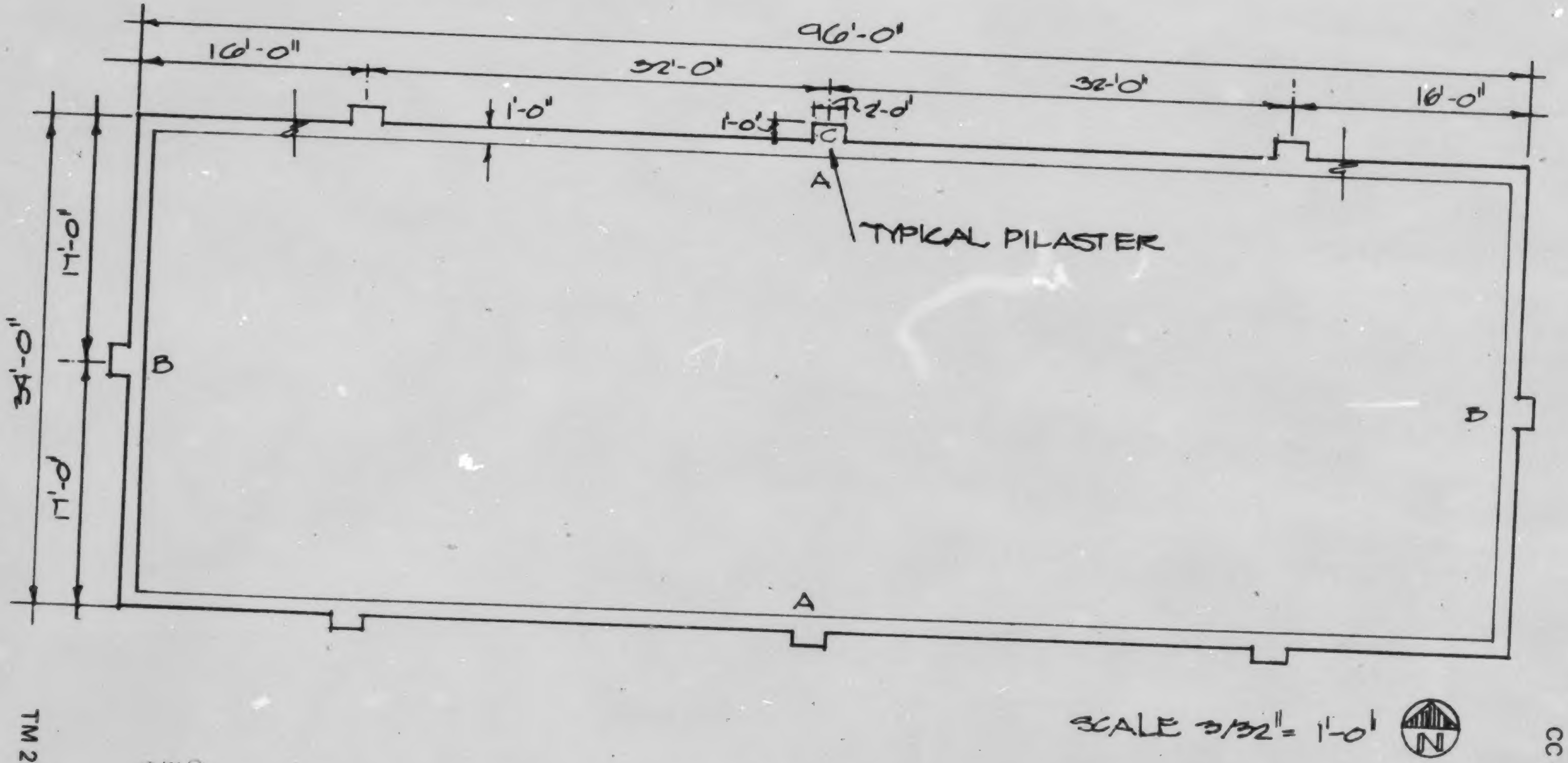
   A. Accessibility of site

   B. Availability of crane or other mechanical lifting device

Parts of a Form


Cleat
Spreader
Top Plate
Spacer Block
Stud
Waler
Scab
Sheathing
Form Tie
Spreader Washers
Bottom Plate
Sole Plate
Strongback
Brace
Stake
Key
Bulkhead

Plan of Foundation


96'-0"
16'-0"
32'-0"
32'-0"
16'-0"
1'-0"
1'-0"
2'-0"
C
A
TYPICAL PILASTER
B
B
A
11'-0"
11'-0"
24'-0"
SCALE 3/32" = 1'-0"
N

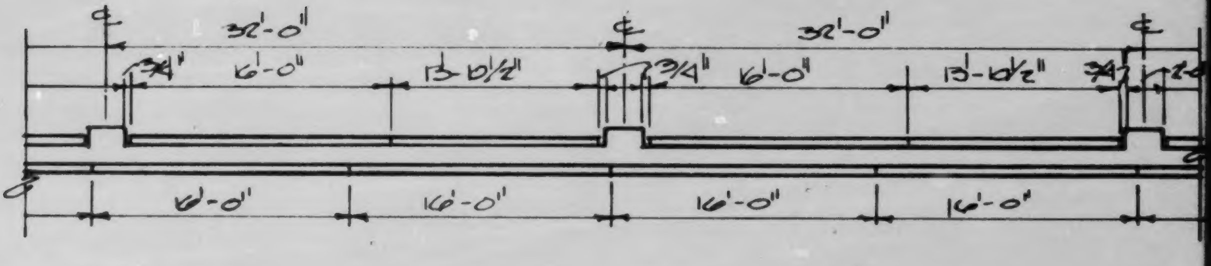
TM 2

973

CC - 159-

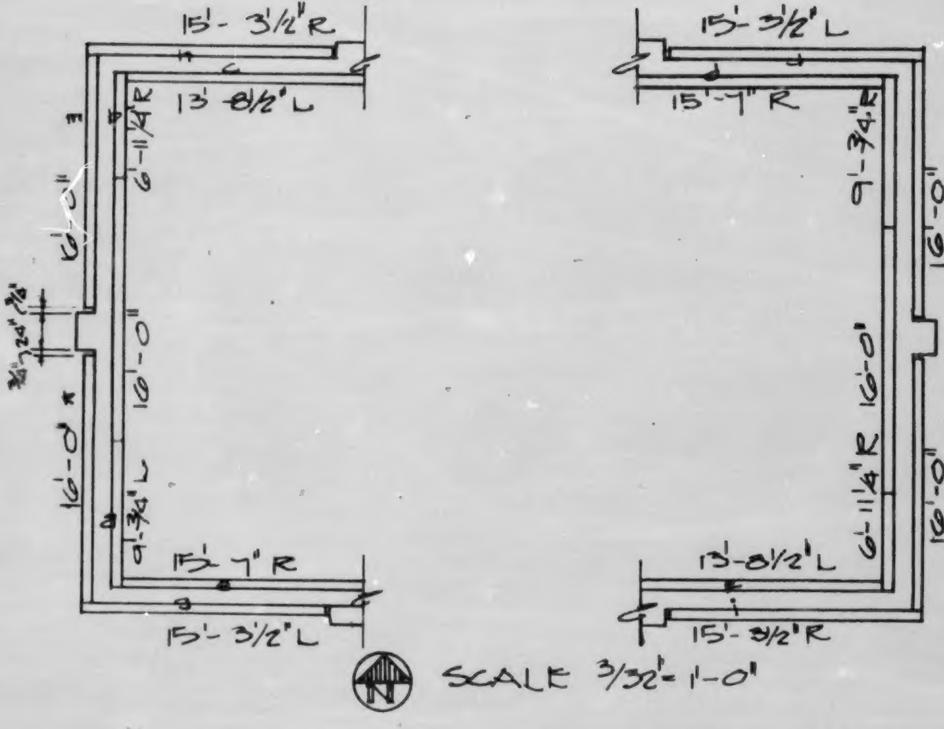
974

Section A of Foundation


℄
32'-0"
℄
32'-0"
℄
3/4"
16'-0"
13'-10 1/2"
3/4"
16'-0"
13'-10 1/2"
3/4"
16'-0"
16'-0"
16'-0"
16'-0"

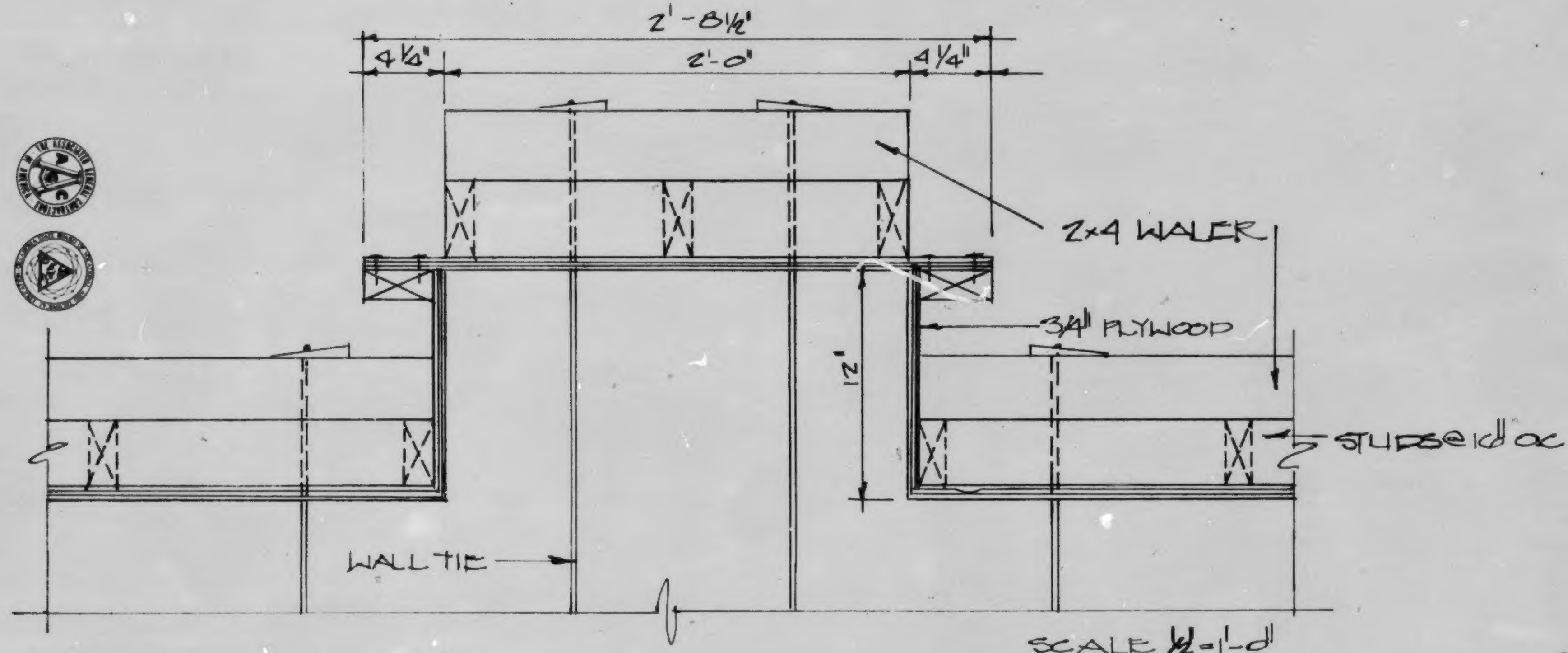
SCALE: 3/32" = 1'-0"

Section B of Foundation Plan

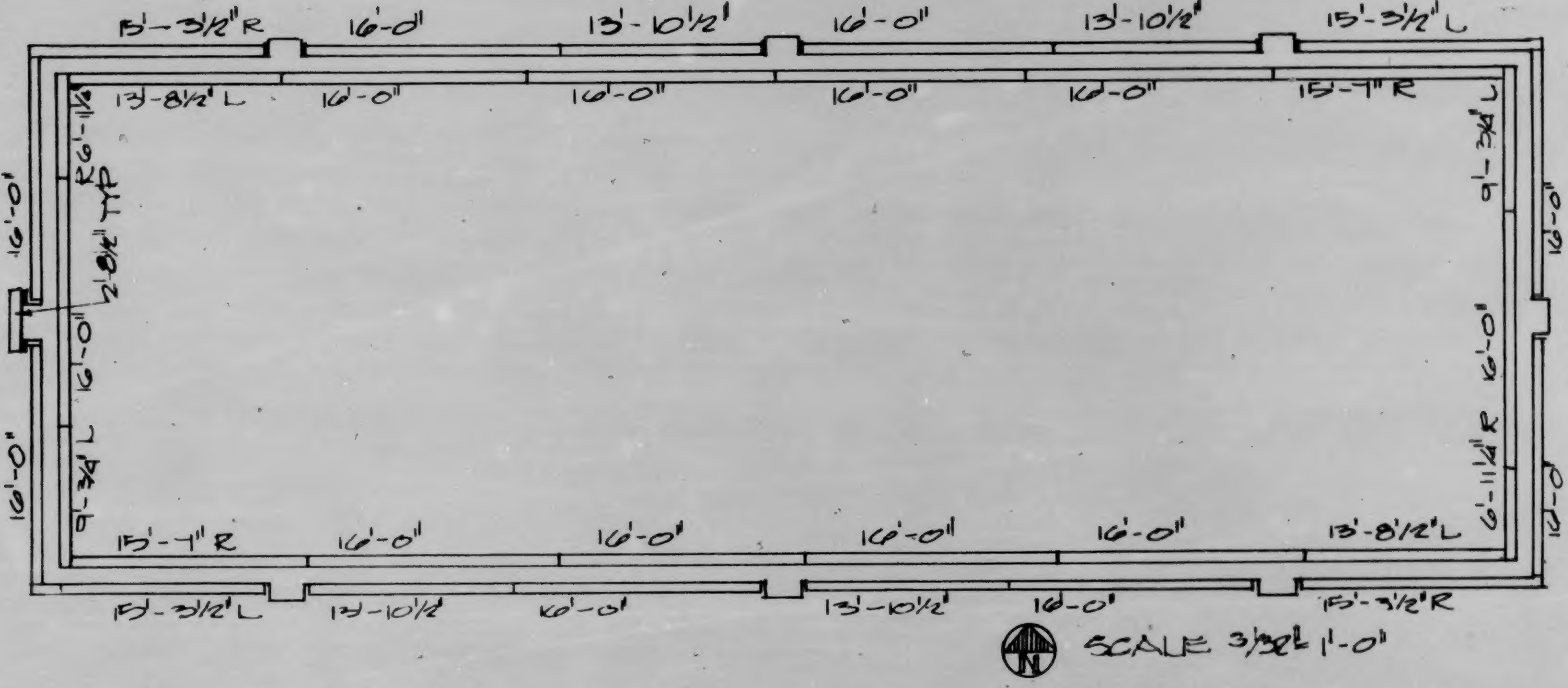


15'-3½"R
13'-8½"L
6'-11¼"R
16'-0"
16'-0"
16'-0"
¾"
24"
¾"
9'-3¾"L
15'-7"R
15'-3½"L
15'-3½"L
15'-7"R
9'-3¾"R
16'-0"
16'-0"
16'-0"
6'-11¼"R
13'-8½"L
15'-3½"R
N
SCALE 3/32"=1'-0"

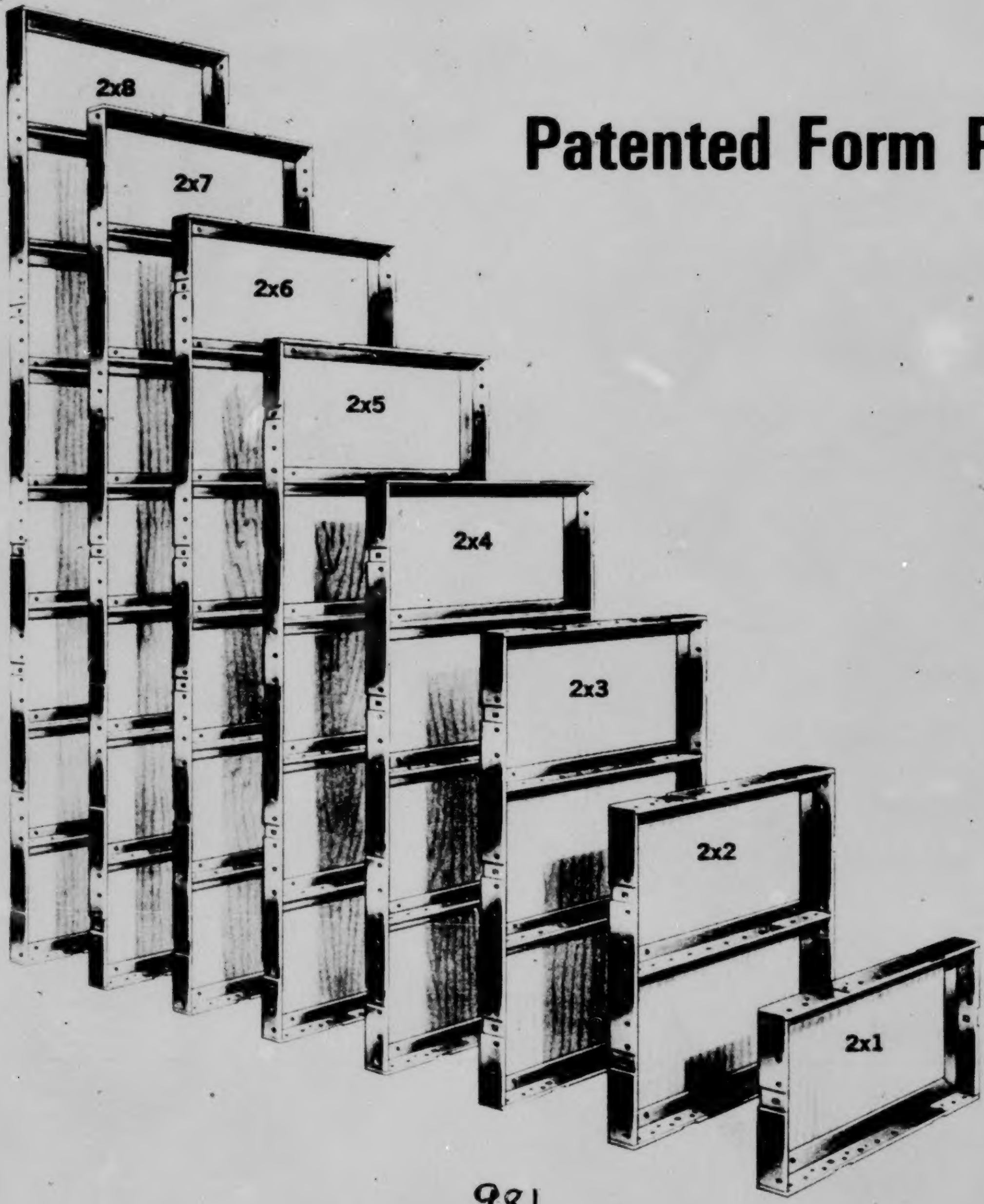
Typical Pilaster Form


2'-8½"
4¼"
2'-0"
4¼"
2×4 WALER
¾" PLYWOOD
12"
STUDS@16" OC
WALL TIE
SCALE ½"=1'-0"

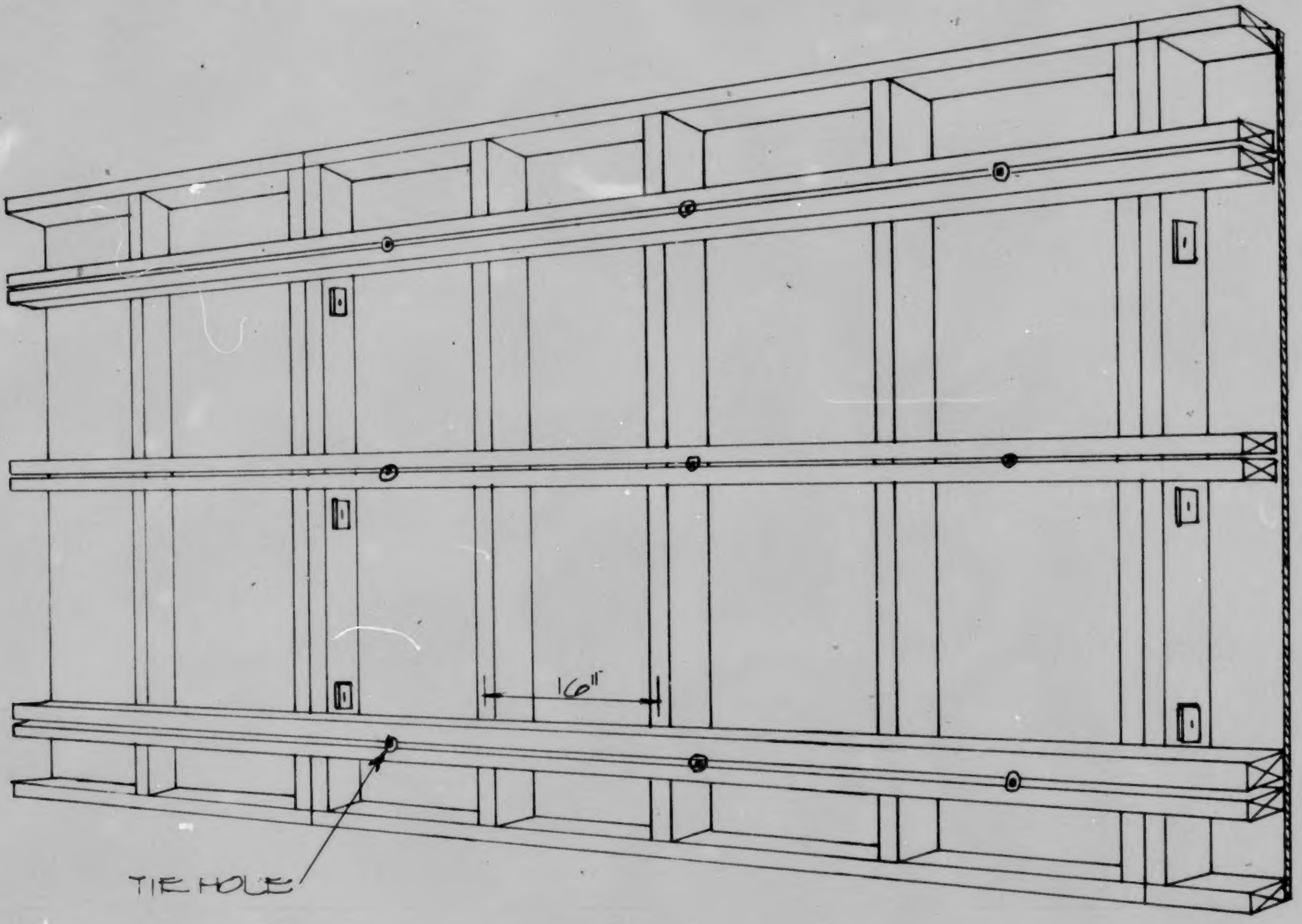
Panel Layout and Sizes


15'-3½" R
16'-0"
13'-10½"
16'-0"
13'-10½"
15'-3½" L
13'-8½" L
16'-0"
16'-0"
16'-0"
16'-0"
15'-7" R
R6'-1¼"
2'-8½" TYP
16'-0"
16'-0"
16'-0"
9'-3¾" L
9'-3¾" L
16'-0"
16'-0"
6'-11¼" R
16'-0"
15'-7" R
16'-0"
16'-0"
16'-0"
16'-0"
13'-8½" L
15'-3½" L
13'-10½
16'-0"
13'-10½
16'-0"
15'-3½" R
N
SCALE 3/32" = 1'-0"

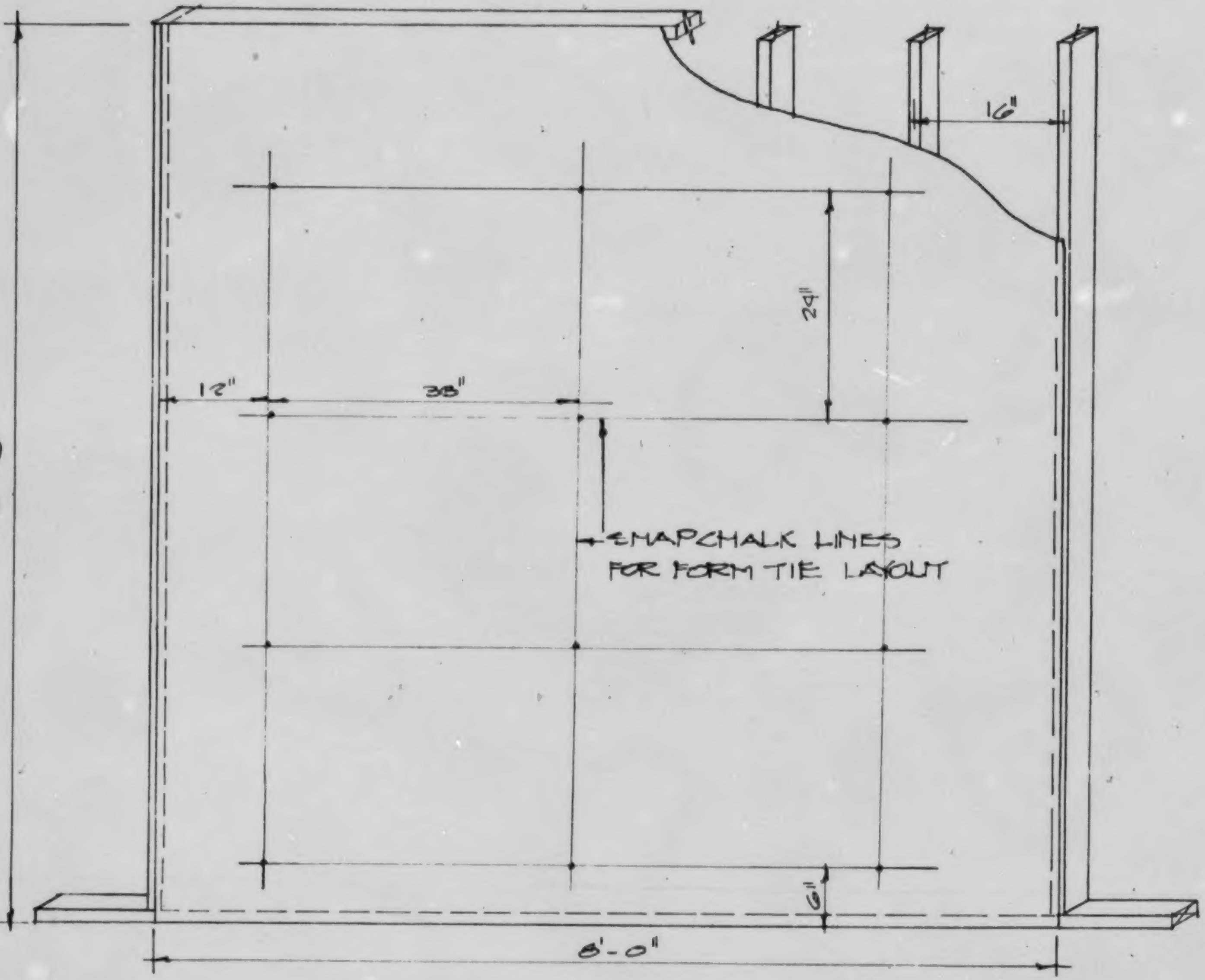
Patented Form Panels


2x8
2x7
2x6
2x5
2x4
2x3
2x2
2x1

Job-Built Panel Form



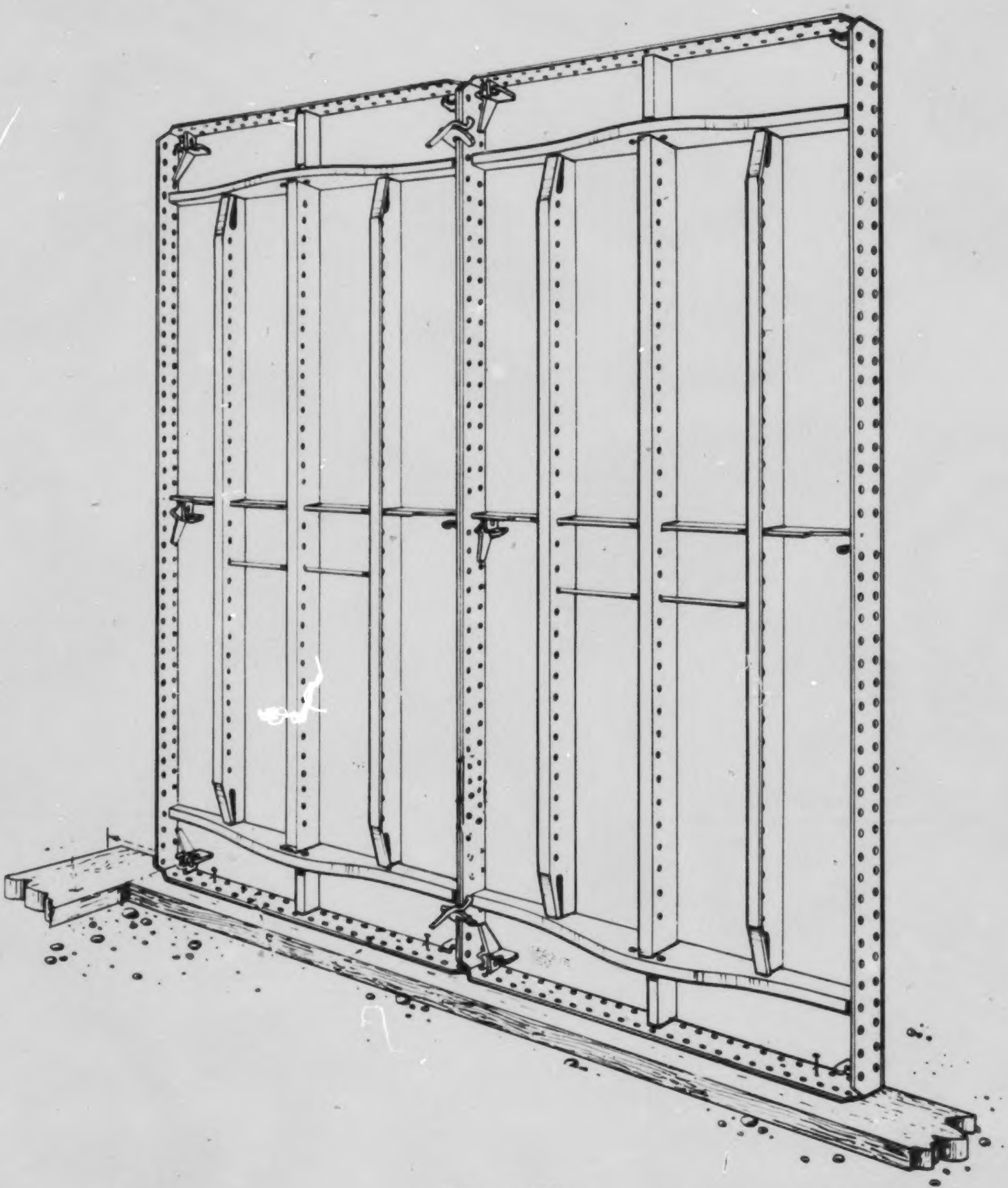
Built-in-Place Wood Form


8'-0"
16"
24"
12"
38"
SNAPCHALK LINES
FOR FORM TIE LAYOUT
6"
8'-0"

SCALE 3/4" = 1'-0"

CC - 175-G

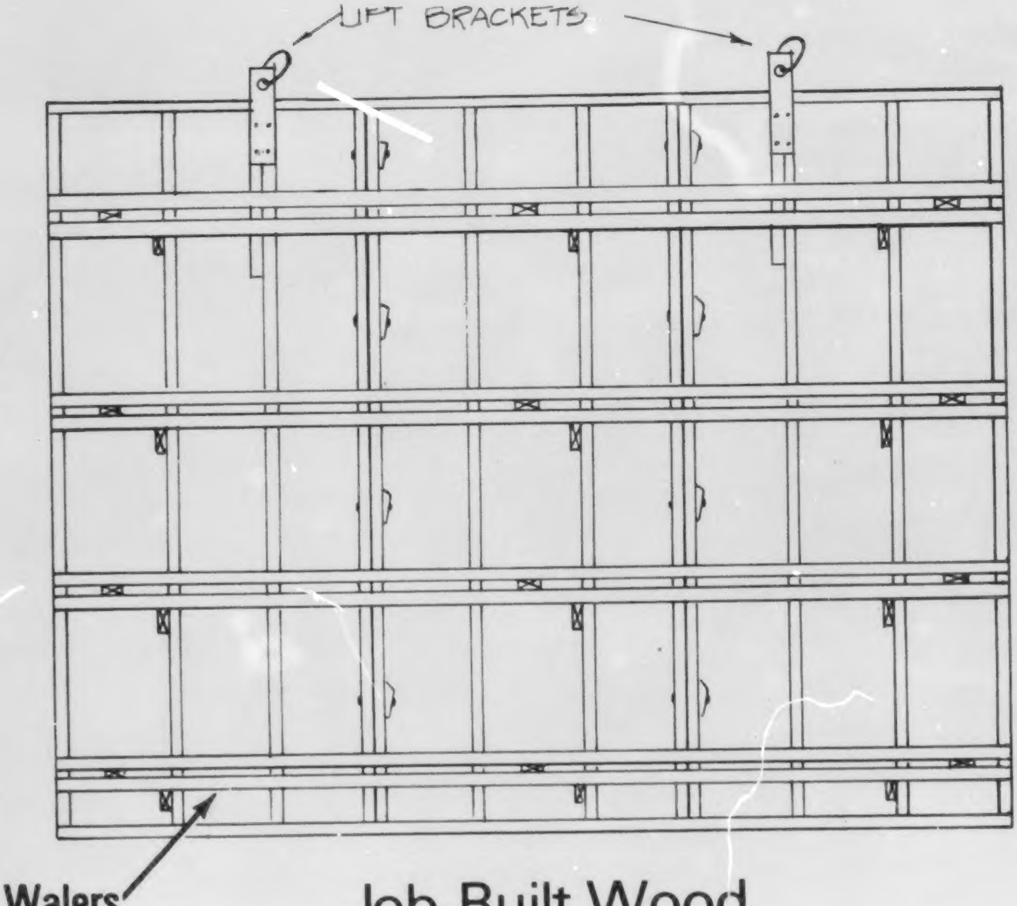
Erected-In-Place Patented Form



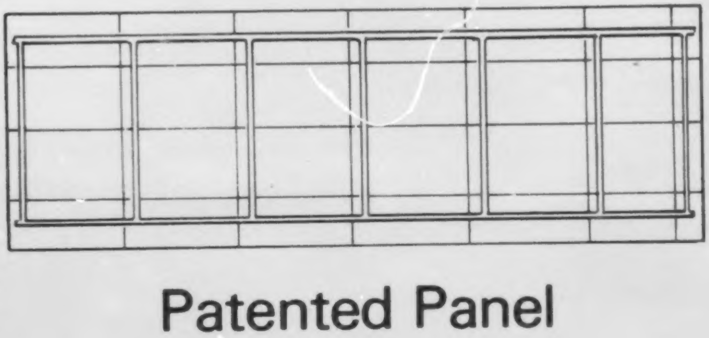
THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA

TM 10

Gang Forms

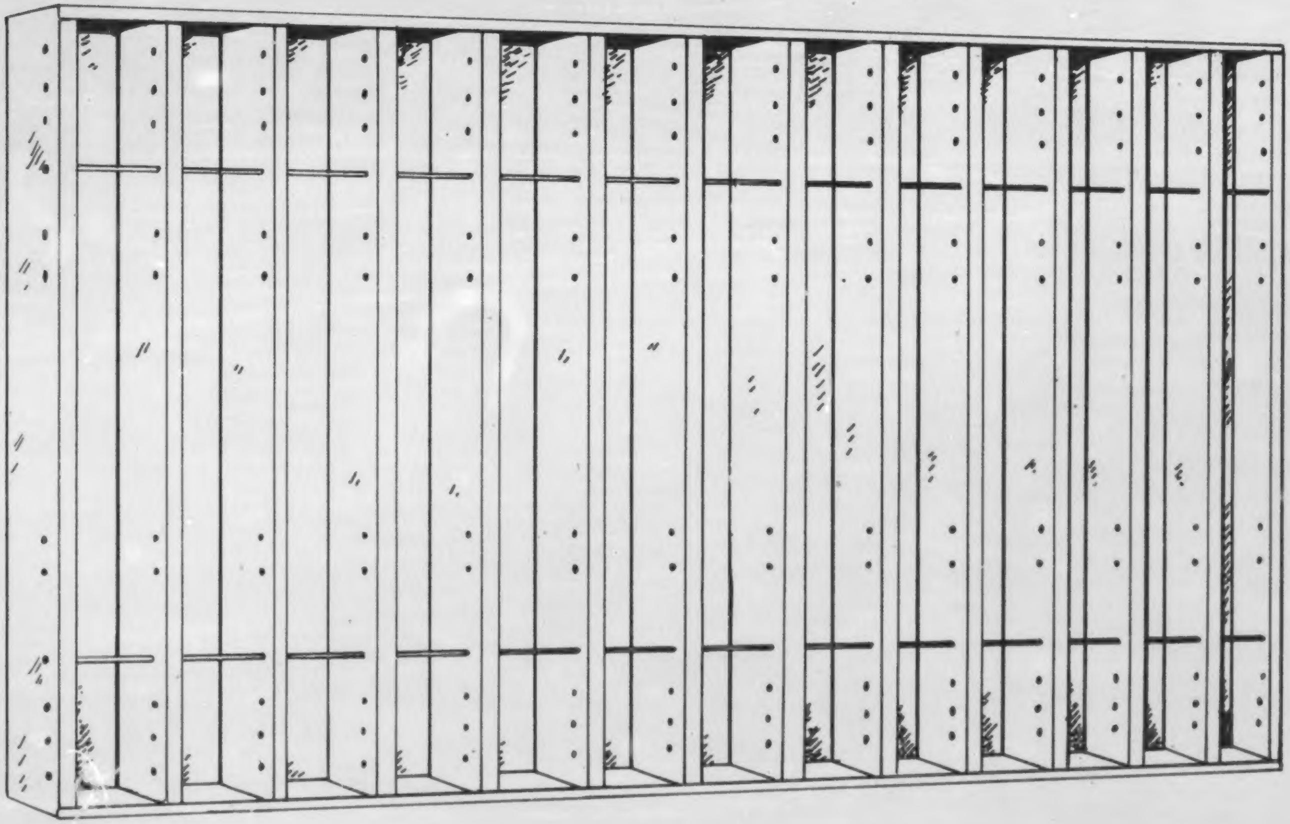

LIFT BRACKETS
Walers

Job-Built Wood



Patented Panel

Steel Plate Girder Forms

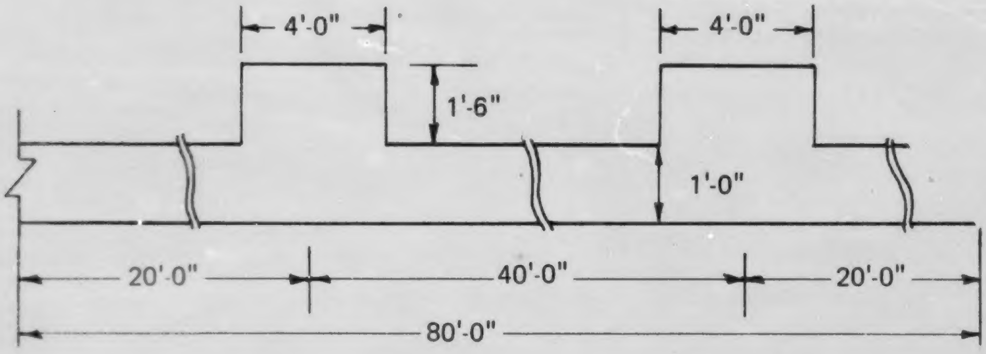


WALL FORMS
UNIT IV

ASSIGNMENT SHEET #1--MATERIAL ESTIMATING

Using the information sheet, estimate the material needed to build forms for the section of wall shown below.

(NOTE: Wall is 1'-0" thick and 12'-0" high; temperature is 50°; the rate of pour is 5' per hour.)



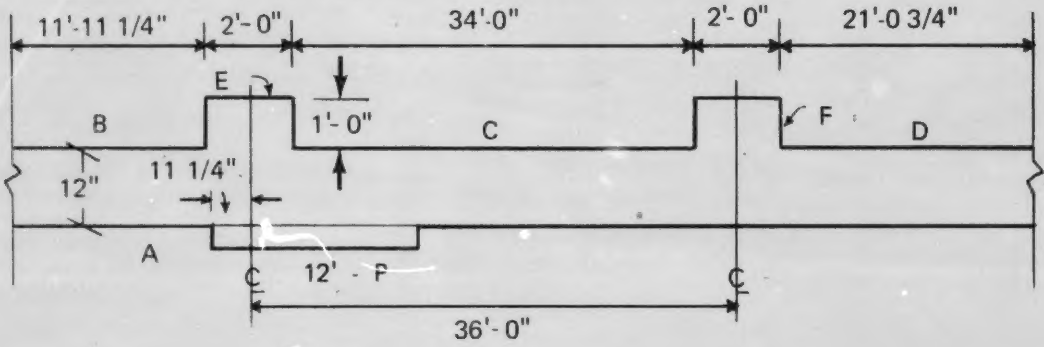
1. Studs (2 x 4, 16" on center) ________________
2. Sheathing (plywood) ________________
3. Plates (2 x 4) ________________
4. Walers (2 x 4) ________________
5. Waler spacer block and supports (1 x 4) ________________
6. Braces (2 x 4) ________________
7. Stakes (2 x 4 x 3') ________________
8. Form ties
    a. Wall ________________
    b. Pilaster ________________
9. Form tie clamps ________________

8

WALL FORMS
UNIT IV

ASSIGNMENT SHEET #2--ESTIMATE WIDTH AND NUMBER OF PANELS

Using the information sheet, estimate the size and quantity of panels needed to form the wall section shown below.



(NOTE: Main panels are 12' wide and the starting location of panel is shown.)

	NUMBER	WIDTH
1. Wall A		
Main panels	____	____
Filler panels	____	____
2. Wall B		
Main panels	____	____
Filler panels	____	____
3. Wall C		
Main panels	____	____
Filler panels	____	____
4. Wall D		
Main panels	____	____
Filler panels	____	____
5. Pilasters E and F		
Face panels	____	____
Side panels	____	____

WALL FORMS
UNIT IV

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. 132-2 x 4's, 12' long
2. 42 pcs. 4' x 12' plywood
3. 20-2 x 4's, 16' long
4. 124-2 x 4's, 16' long
5. 246 lin. ft. of 1 x 4's
6. 21-2 x 4's, 14' long
7. 21-2 x 4's, 3' long
8. a. 156, 1'-0"
   b. 24, 2'-6"
9. 360

Assignment Sheet #2

	NO.	WIDTH
1.	5	12'-0"
	1	11'-0"
2.	0	0
	1	11'-10 1/2"
3.	2	12'-0"
	1	9'-10 1/2"
4.	1	12'-0"
	1	9"-0"
5.	2	2"-8 1/2"
	4	1'-0"

WALL FORMS
UNIT IV

JOB SHEET #1--CONSTRUCT STRAIGHT WALL WITH PATENTED FORMS

I. Tools and materials

A. Tools

1. Electric handsaw
2. Crosscut handsaw
3. Claw hammer, 16 oz or larger
4. Sledge hammer
5. Tape measure, 100 foot
6. Tape measure, 12 or 16 foot
7. Level, hand
8. Builder's level
9. Electric drill and bits
10. Chalk line
11. All special tools supplied by the form manufacturer
12. Plumb bob
13. Framing square
14. Powder actuated tool

    (NOTE: Powder actuated tools may be used only by a licensed operator.)

15. Wrench adjustable, 16"

B. Materials

1. Stakes
2. 2 x 4's or 2 x 6's for braces, plates, and strongbacks

JOB SHEET #1

3. Patented forms and accessories

   (NOTE: No two companies make the same type of form ties, panel clamps, aligner clamps, or panels. When a particular type is selected, that system must be referred to for all accessories and installation instructions.)

4. Pins for powder actuated tool

5. 1 x 2's for grade strips

6. Duplex nails

7. Concrete nails

II. Procedure

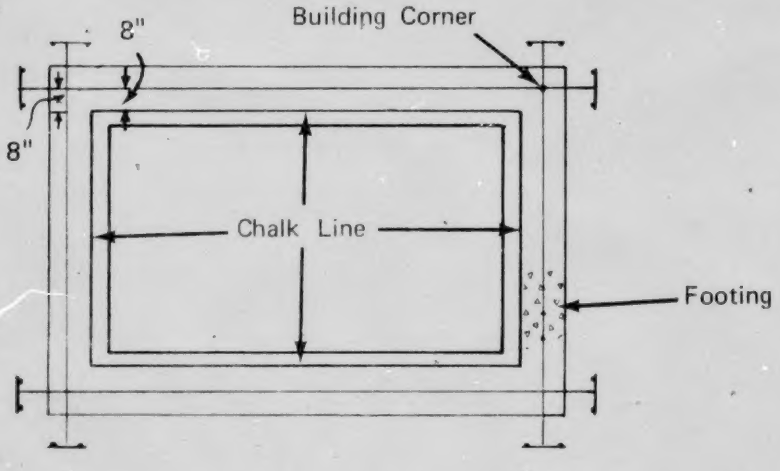
A. Transfer the building corners from the batter boards to the footing

(NOTE: Use plumb bob.)

B. Snap a chalk line on the footing on the side set first

(NOTE: Either side may be set first. Figure 1 shows inside set first.)

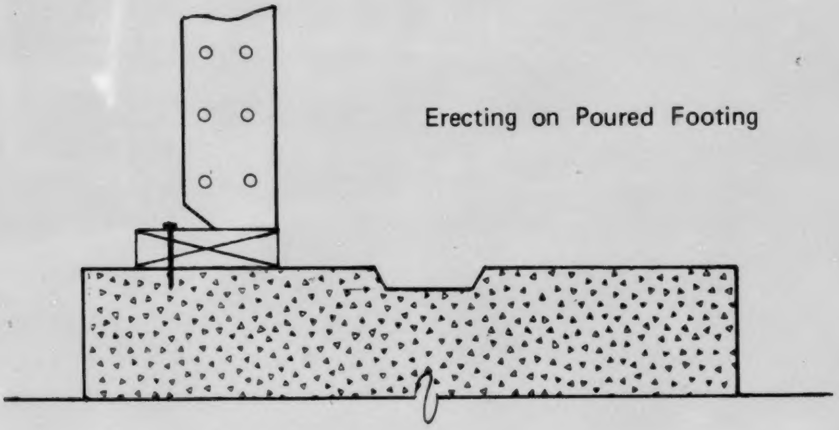
FIGURE 1



JOB SHEET #1

C. Secure 2 x 4 plates to footing using either 2 1/2" concrete nails or powder actuated tool with 2 1/2" pins (Figure 2)

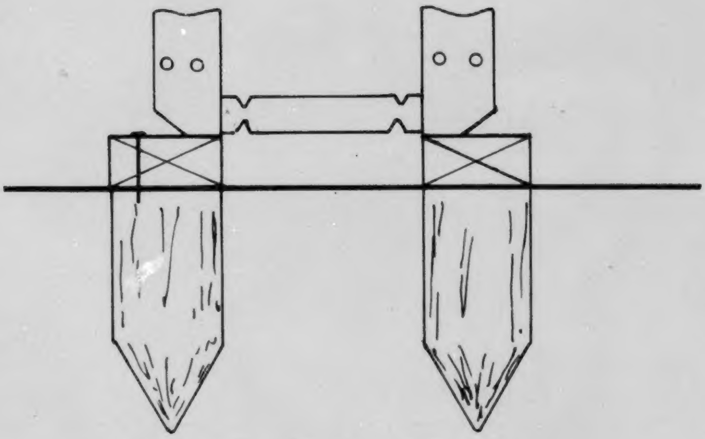
FIGURE 2



Erecting on Poured Footing

(NOTE: If erecting without footing, drive stakes to support plate as shown in Figure 3.)

FIGURE 3



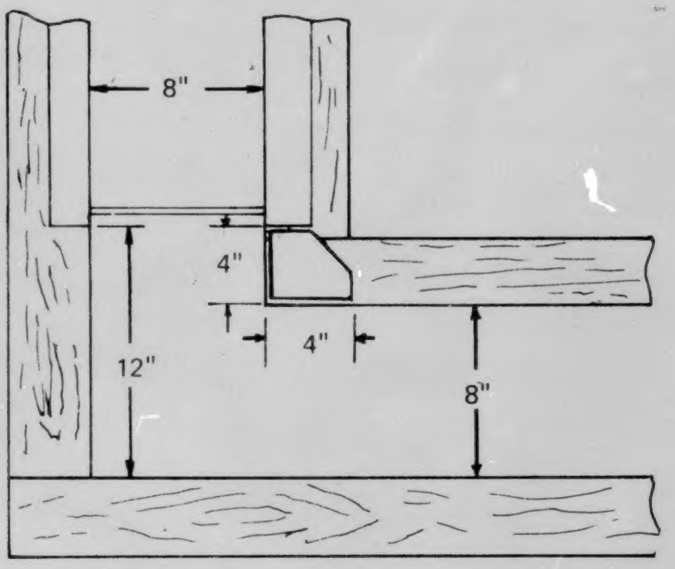
Erecting on Dirt Without Footing

JOB SHEET #1

D. Lay out location of panels at corner (Figure 4)

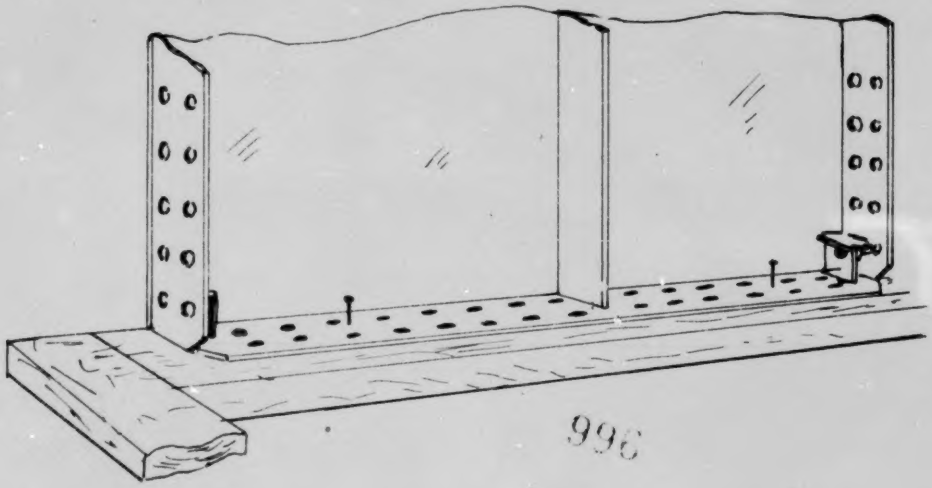
(NOTE: Panels must be directly opposite each other. Figure 4 shows an inside corner panel. There are many others used by patent form manufacturers. Consult the manufacturer's literature for specific corner layout.)

FIGURE 4



E. Nail a form panel to the base plate in the nail holes provided at both ends of the plate (Figure 5)

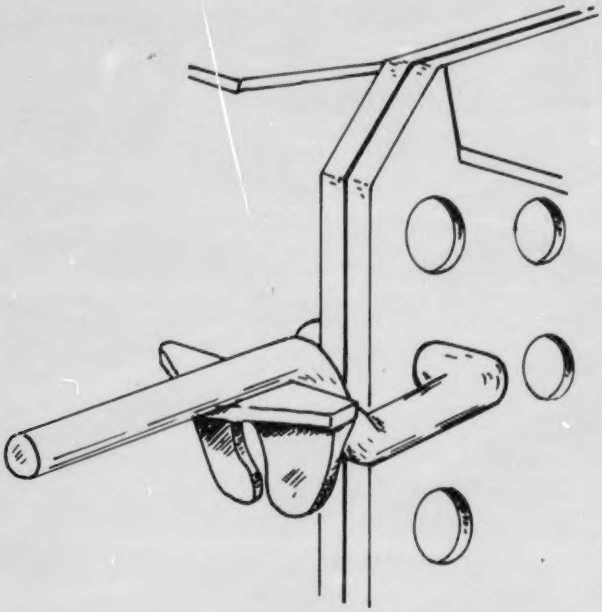
FIGURE 5



JOB SHEET #1

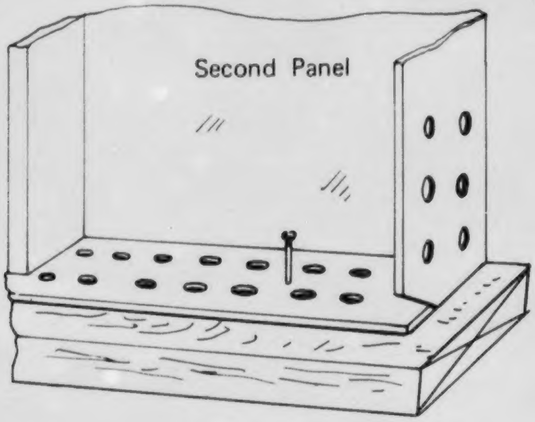
F. Set the adjacent form panel in place and install clamp (Figure 6)

FIGURE 6



G. Push the panel into alignment with the base plate and nail (Figure 7)

FIGURE 7



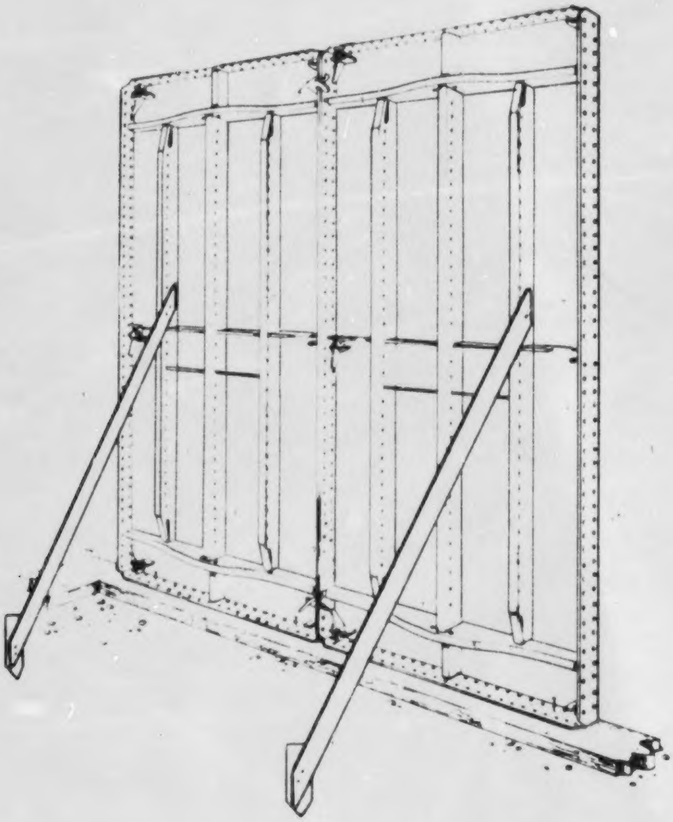
H. Repeat steps F and G to continue erection on the first row

JOB SHEET #1

I. Set up remaining rows and secure to adjoining panels (Figure 8)

(NOTE: Temporary braces will be installed when the panels are stacked to a dangerous height.)

FIGURE 8



J. Install aligners (strongbacks if used)

K. Install braces and align top of form

(NOTE: This alignment can be made by sighting or plumbing with a hand level.)

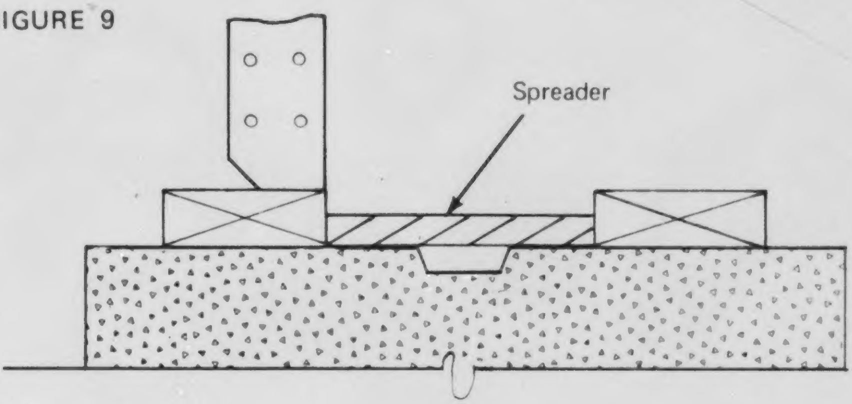
L. Build and install all sleeve pockets, offsets, or blockouts needed in the finished wall

(NOTE: Form oils must be applied before rebars are installed.)

JOB SHEET #1

M. Set plates for opposite side (Figure 9)

FIGURE 9



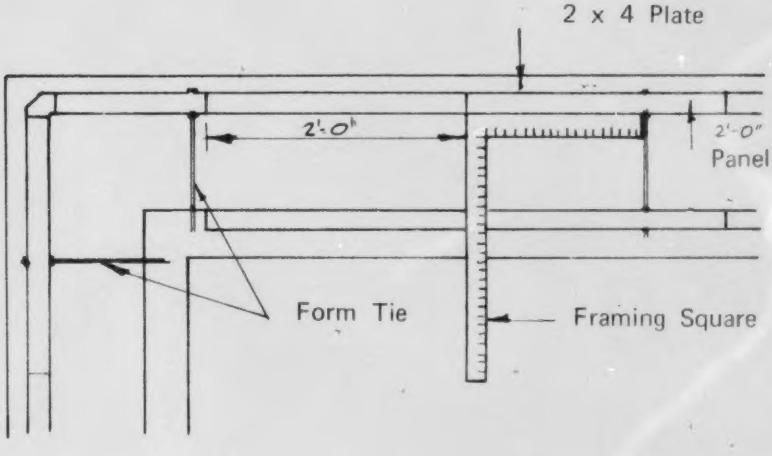
N. Install form ties

(NOTE: Some form systems install ties when erecting the first side of the form.)

O. Erect second side of form following the same procedures outlined in steps E to I (Figure 10)

(NOTE: Erection can start any place along the wall.)

FIGURE 10


2 x 4 Plate
2'-0"
2'-0"
Panel
Form Tie
Framing Square

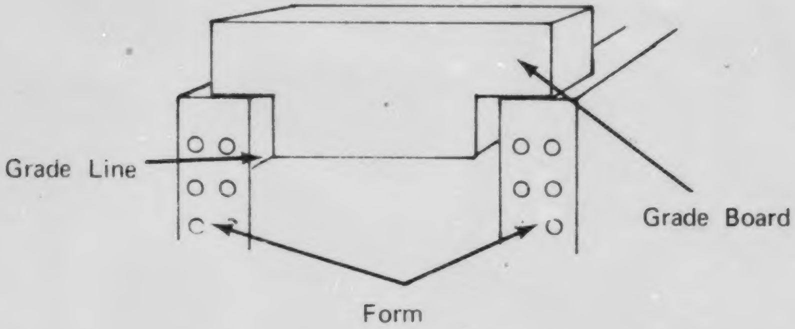
JOB SHEET #1

P. Establish the concrete grade

1. Grade board (Figure 11)

   (NOTE: This method may be used if most of the panels are the same height and level on top.)

FIGURE 11

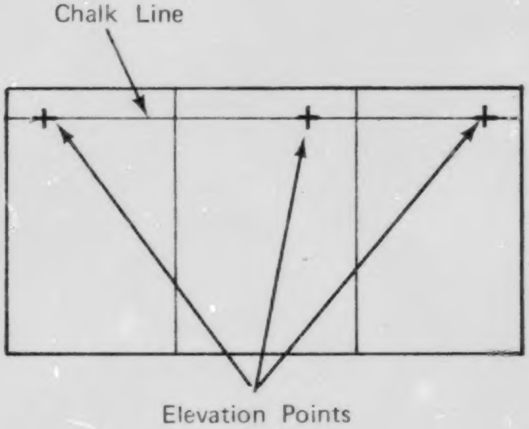

Grade Line
Grade Board
Form

2. Grade strip

   a. Measure from top of form or establish elevation points with builder's level

   b. Snap a chalk line to mark grade (Figure 12)

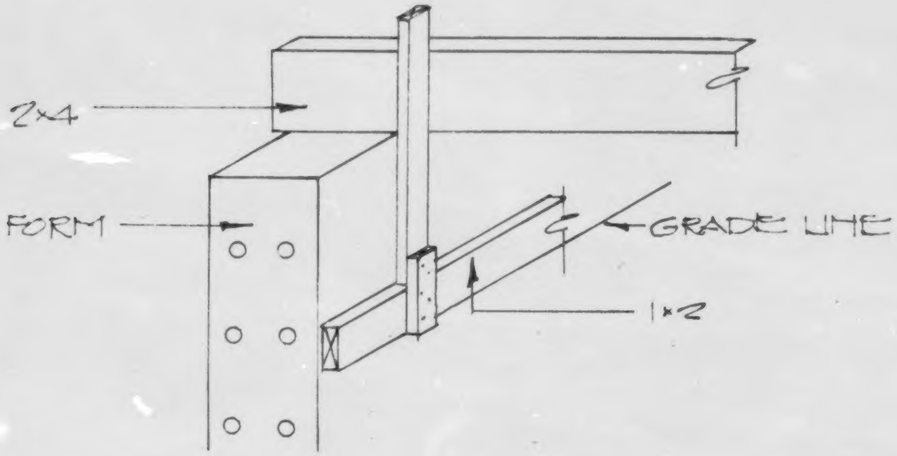
FIGURE 12


Chalk Line
Elevation Points

JOB SHEET #1

c. Attach grade strip by fastening to a hanger that is nailed across top of form (Figure 13)

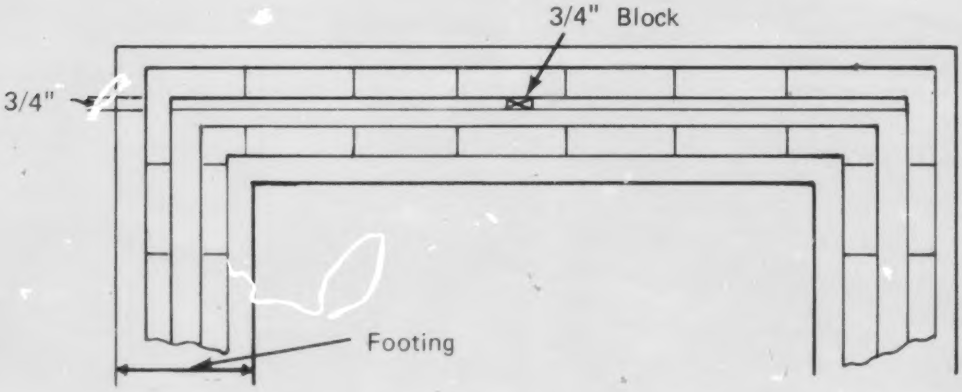
FIGURE 13


2x4
FORM
GRADE LINE
1x2

(NOTE: Nail to panel if wood sheathing is used on form system.)

Q. Recheck form alignment (Figure 14)

FIGURE 14


3/4" Block
3/4"
Footing

1. Secure line to top of form 3/4" out from face of form; draw taut
2. Use a 3/4" hand-held block to check alignment at intermediate points
3. Adjust braces to secure alignment

WALL FORMS
UNIT IV

JOB SHEET #2--CONSTRUCT GANG FORMS FOR A BATTERED WALL

I. Tools and materials

   A. Tools

      1. Electric handsaw
      2. Crosscut handsaw
      3. Claw hammer, 16 or 24 ounce
      4. Sledge hammer
      5. Tape measure, 100 foot
      6. Tape measure, 12 or 16 foot
      7. Level, hand, 30"
      8. Builder's level
      9. Electric drill and bits
      10. Chalk line
      11. Powder actuated tool and pins
      12. Plumb bob
      13. Framing square
      14. Wrench, adjustable, 16"

   B. Materials

      1. Stakes
      2. 2 x 4's or 2 x 6's for plates and braces
      3. Panels
      4. Form ties
      5. Walers
      6. Waler brackets
      7. Duplex nails
      8. Concrete nails

JOB SHEET #2

II. Procedure

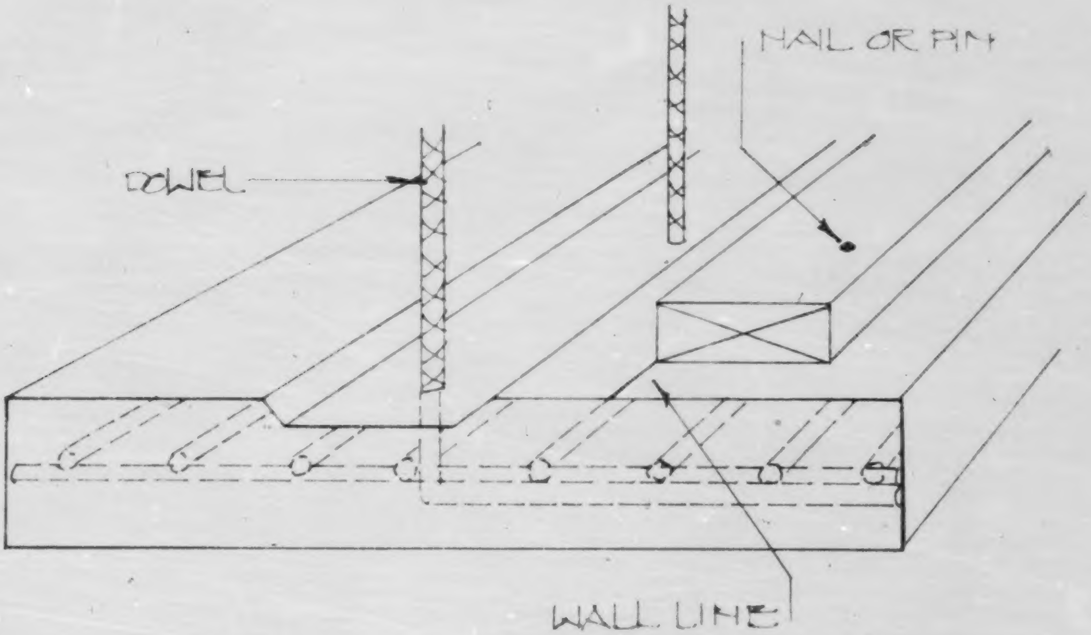
A. Locate wall line on footings

B. Snap a chalk line on the footing at the plumb side of the wall

C. Nail sole plates to footings

(NOTE: Use 2 1/2" concrete nails or powder actuated driver with 2 1/2" pins. See Figure 1.)

FIGURE 1



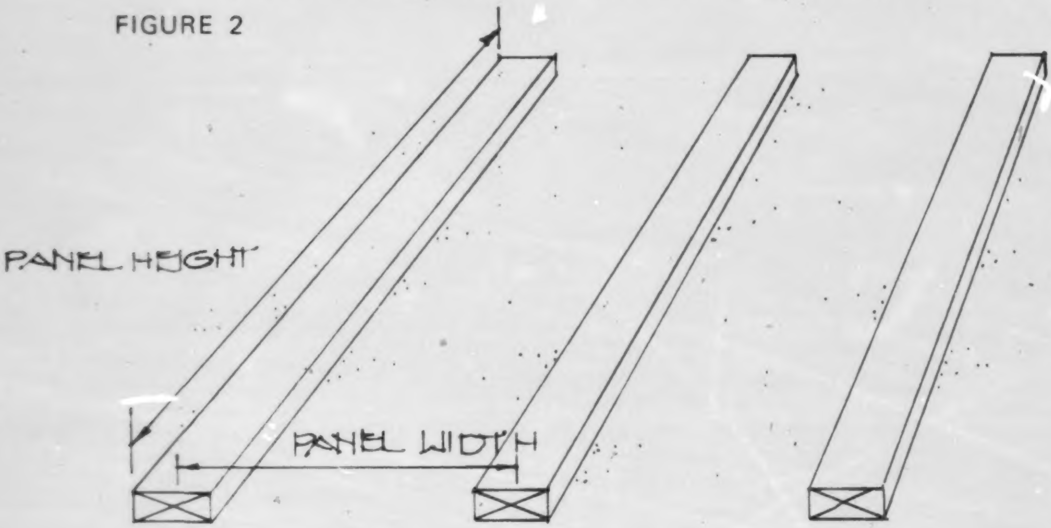
JOB SHEET #2

D. Build gang form

1. Level stringers of 2-inch or thicker material long enough to accommodate gang form (Figure 2)

   (NOTE: The bed may be on the ground or on sawhorses.)

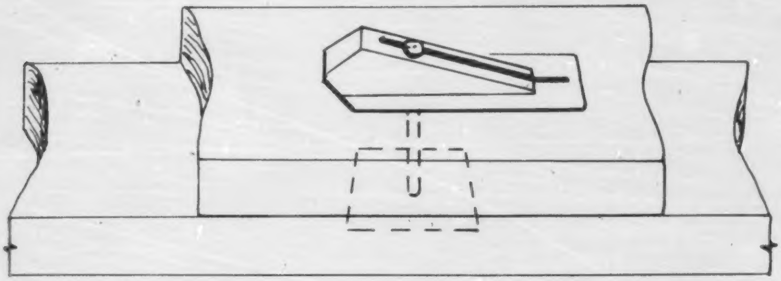
FIGURE 2



2. Lay panels face down on bed

3. Bolt panels together with machine bolts or panel lock bolts (Figure 3)

FIGURE 3



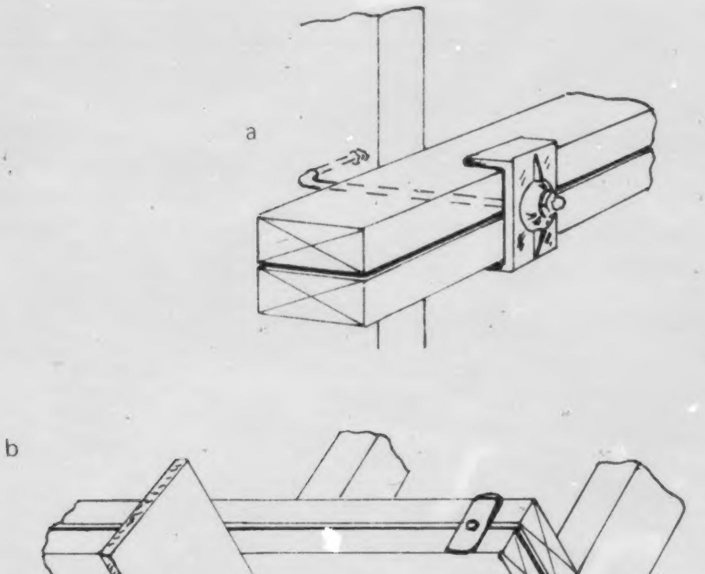
Panel Lock Bolt

JOB SHEET #2

4. Attach waler support brackets (Figures 4a, 4b, and 4c)

   (NOTE: Supports 4b and 4c are nailed to the stud; 4a requires a drilled hole in the stud.)

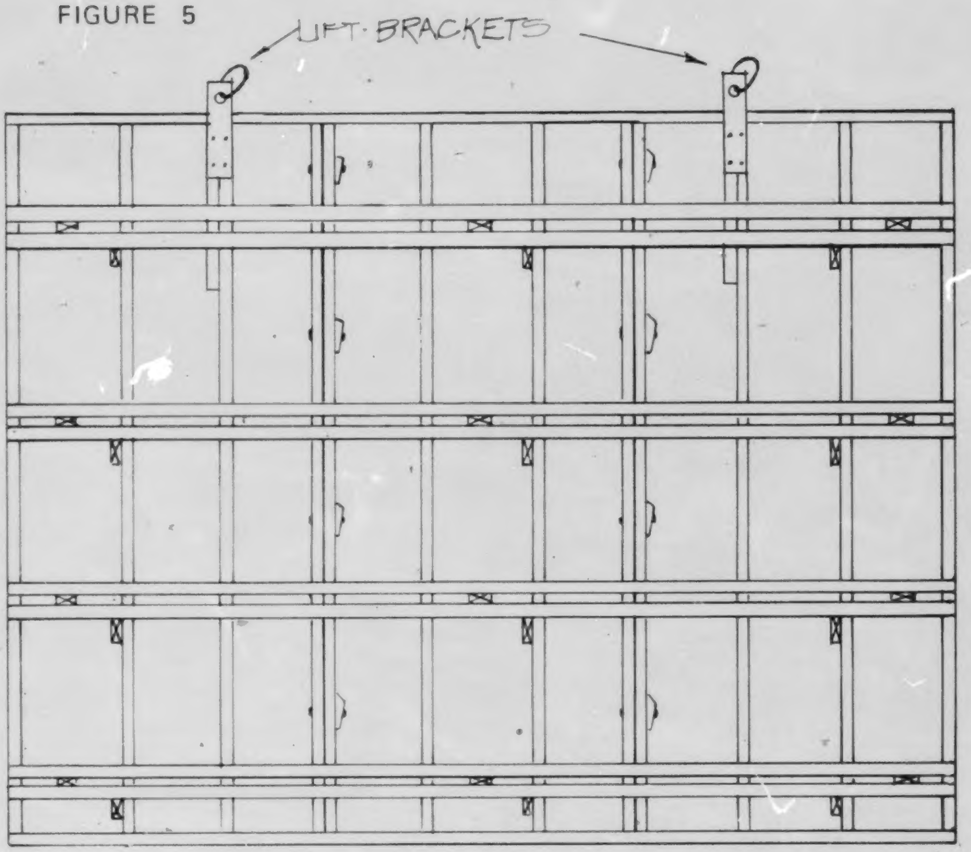
FIGURE 4



JOB SHEET #2

5. Install walers and strongbacks (Figure 5)

FIGURE 5



6. Install lifting brackets as shown in Figure 5

   (NOTE: Position of lifting brackets is determined by length of panel. For long panels, two are recommended.)

7. Build all panels needed for job

   (NOTE: Several factors are used to determine the number of panels needed. They are length of pour, length of wall, erection time, and the length of time form must remain on wall after it is poured.)

8. Lift panel off bed

   (NOTE: A crane or boom truck may be used. Panels may be stored or set as their building progresses.)

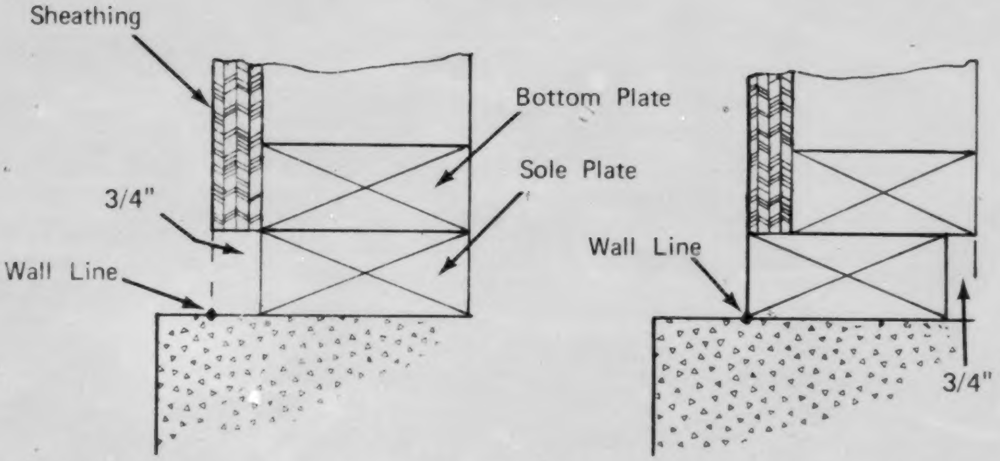
   (CAUTION: All safety precautions should be exercised when lifting panels. Use tag line and all other precautions.)

JOB SHEET #2

E. Erect first side of form

1. Place first panel on sole plate
2. Line face of form with wall line (Figures 6a and 6b)

FIGURE 6


Sheathing
Bottom Plate
Sole Plate
3/4"
Wall Line
Wall Line
3/4"

a b

3. Nail bottom plate to sole plate

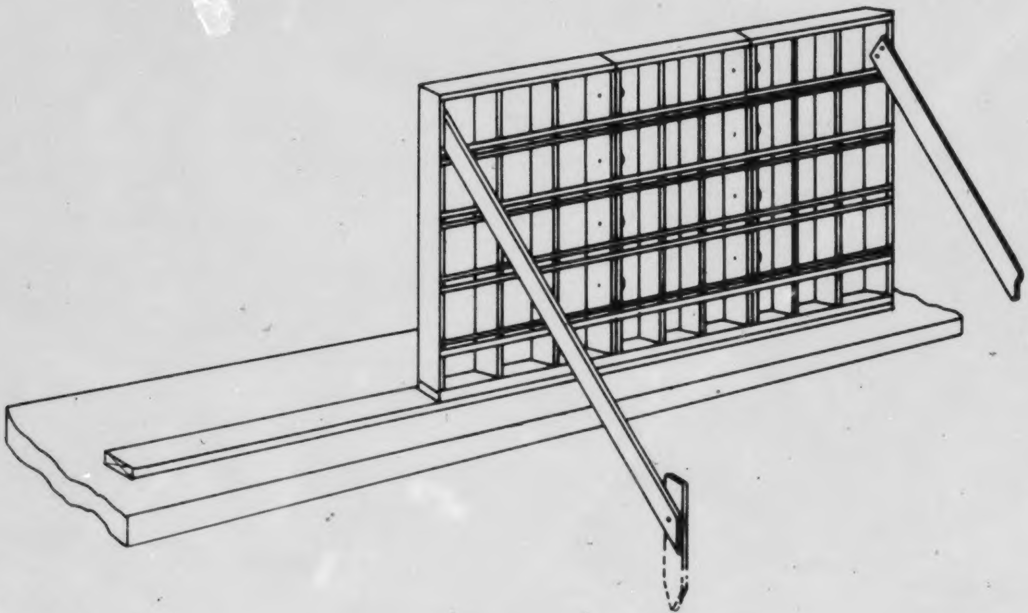
(NOTE: Use 16d duplex nails.)

JOB SHEET #2

4. Brace and plumb panel at both ends (Figure 7)

   (NOTE: Do not cover panel bolt holes.)

FIGURE 7



5. Set adjacent gang form
6. Bolt to first gang form

   (NOTE: Use panel lock bolts as shown in Figure 3.)

7. Line face end with wall line and nail to sole plate
8. Plumb and brace free end
9. Repeat steps 5, 6, 7, and 8 to continue erection

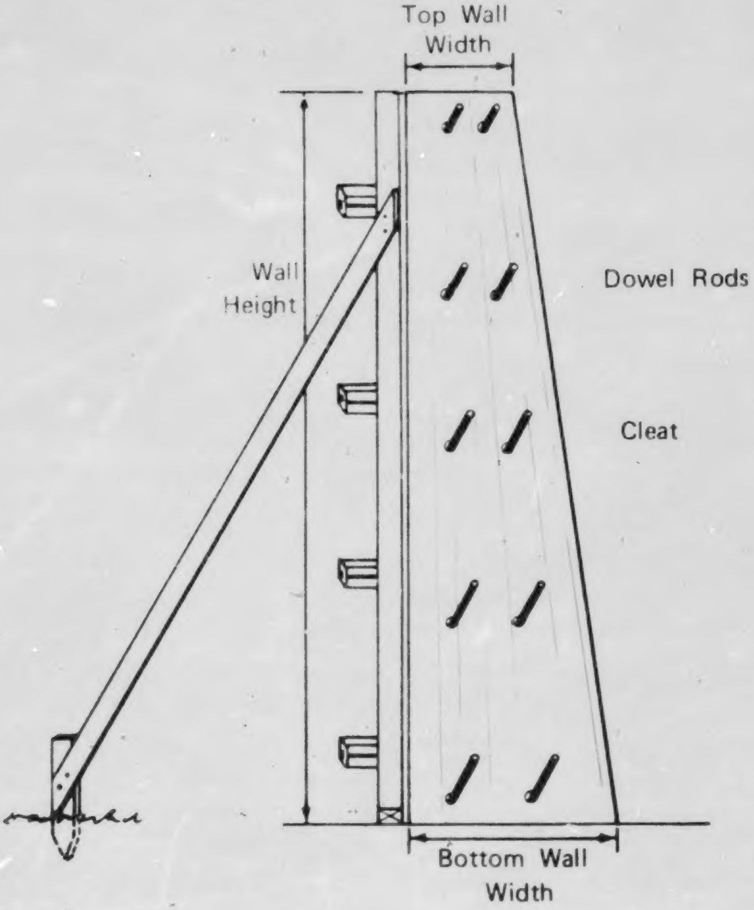
JOB SHEET #2

F. Build and install bulkheads

1. Build bulkhead to height and shape of wall (Figure 8)

   (NOTE: Blocks should be nailed over slots after rebars are installed.)

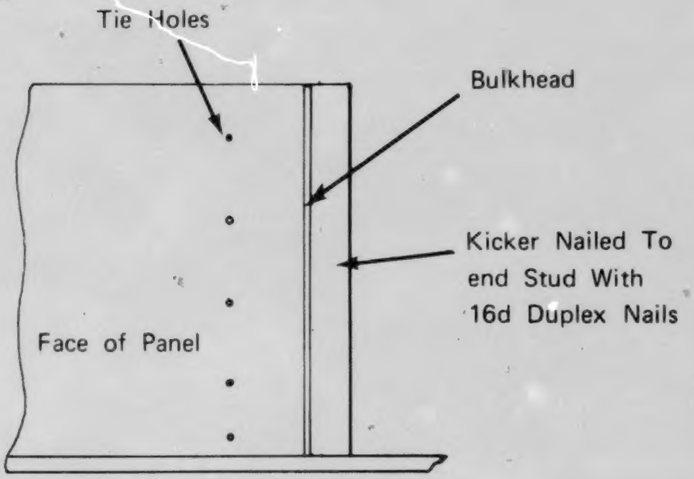
FIGURE 8


Top Wall Width
Wall Height
Dowel Rods
Cleat
Bottom Wall Width

JOB SHEET #2

2. Nail kicker to form at bulkhead location on both ends of form (Figure 9)

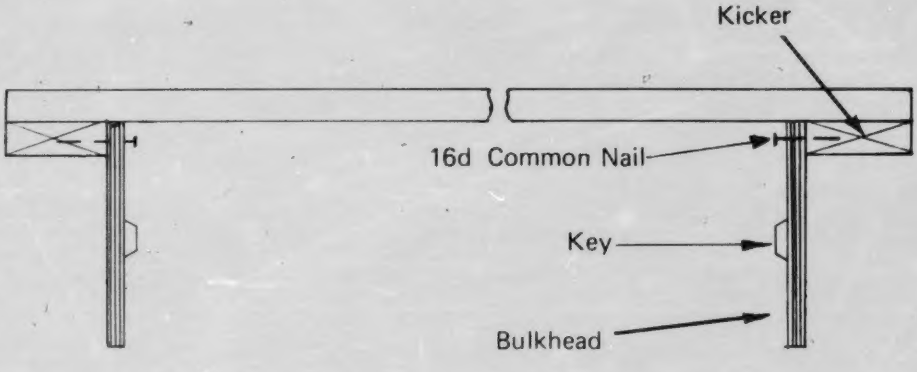
FIGURE 9


Tie Holes
Bulkhead
Kicker Nailed To end Stud With 16d Duplex Nails
Face of Panel

3. Set bulkhead against kicker and nail (Figure 10)

(NOTE: Install bulkheads at both ends of form. Form oil must be applied before rebars are installed. All rebars should be completely installed before second form is in place.)

FIGURE 10


Kicker
16d Common Nail
Key
Bulkhead

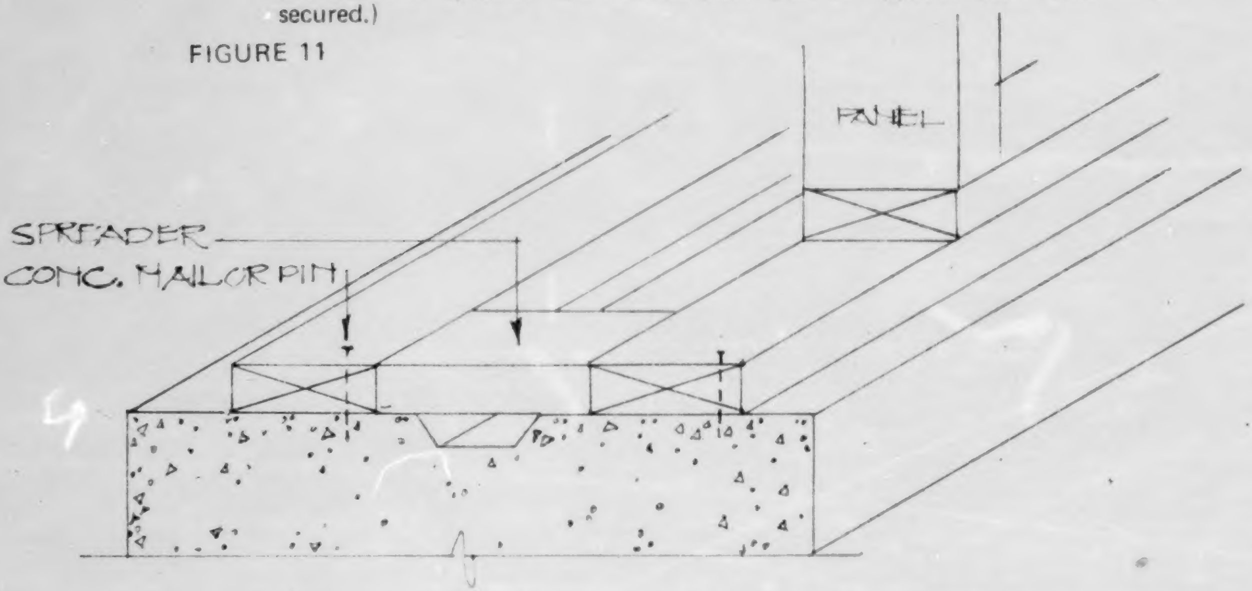
JOB SHEET #2

G. Set second side of forms

1. Set sole plate (Figure 11)

   (NOTE: Use spreader and secure plate just as opposite plate was secured.)

FIGURE 11


PANEL
SPREADER
CONC. NAIL OR PIN

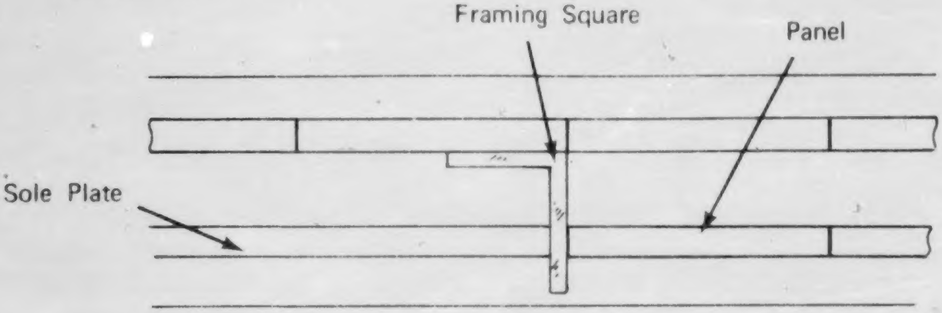
2. Nail bulkhead kicker on first gang form to correspond with opposite sides

   (NOTE: Spreader should be removed after plate is set.)

3. Stand first gang form on sole plate (Figure 12)

   (NOTE: Position form squarely across from opposite form. Tack spreaders to form.)

FIGURE 12


Framing Square
Panel
Sole Plate

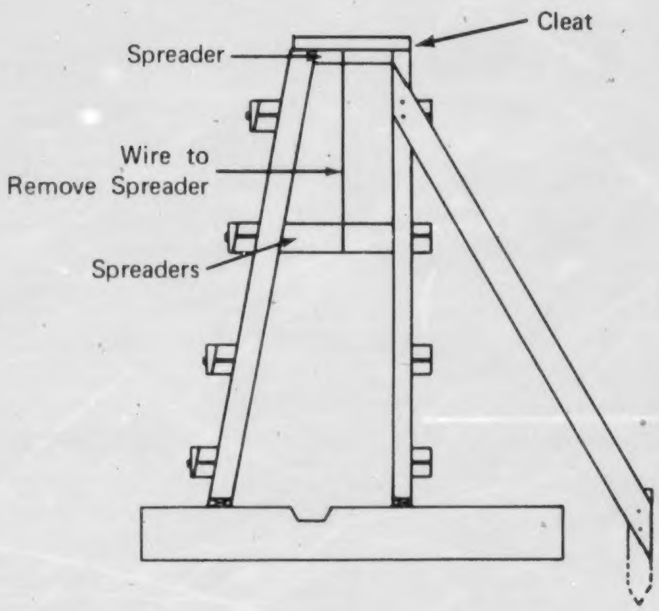
4. Place on wall line and nail to soleplate

JOB SHEET #2

5. Nail a cleat across both ends of the form to hold it in place (Figure 13)

(NOTE: Maintain correct wall thickness at lead end. The back end is against bulkhead. Braces may not be needed on this side.)

FIGURE 13



(NOTE: Spreader can be removed by driving one end down. This will release the pressure, then it can be pulled out with the wire.)

6. Set adjacent gang form

7. Bolt to first gang form

(NOTE: Use panel lock bolts as shown in Figure 3.)

8. Nail cleat across top of form at free end as shown in Figure 13

9. Repeat steps 5, 6, and 7 to continue erection

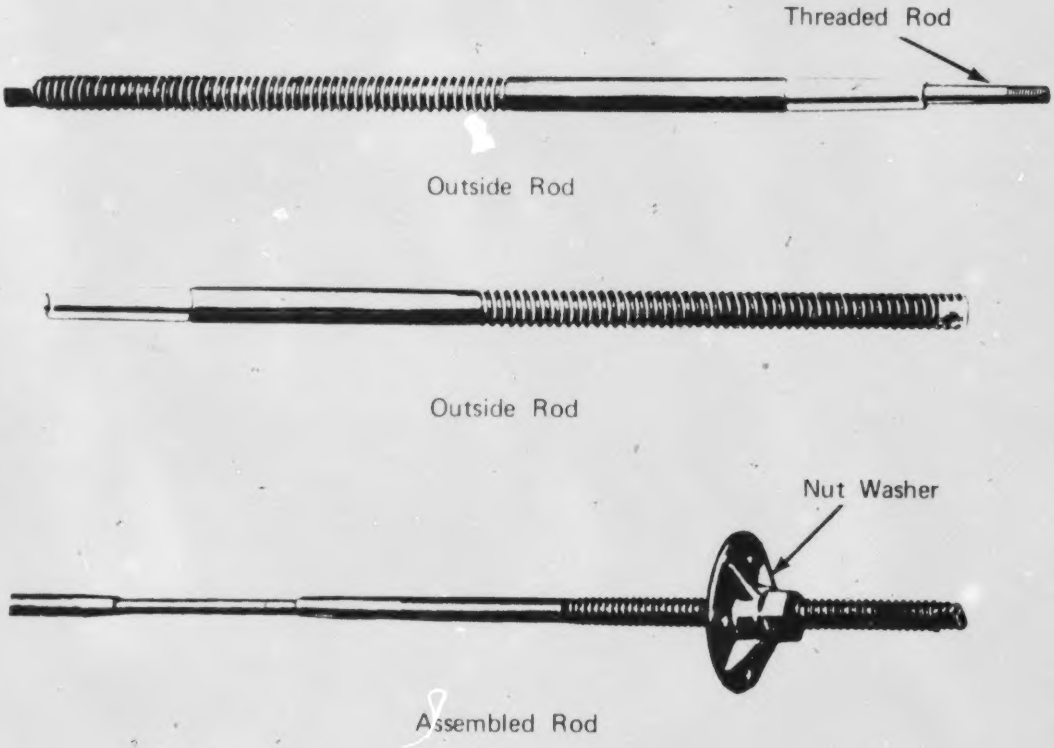
JOB SHEET #2

H. Install form ties

1. Assemble form ties (Figure 14)

   (CAUTION: Threaded rod should be screwed into outside rod for full thread.)

FIGURE 14


Threaded Rod
Outside Rod
Outside Rod
Nut Washer
Assembled Rod

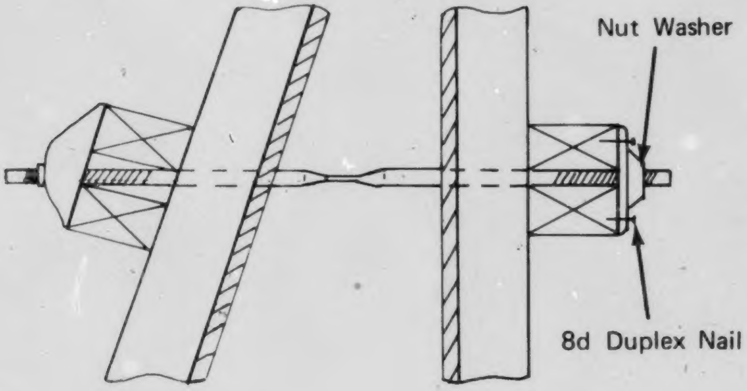
(NOTE: There are she bolts available with outside spacing capabilities, thereby eliminating the need for spreader and tightening sequence.)

JOB SHEET #2

2. Place form tie assembly through forms from the plumb side (Figure 15)

   (NOTE: Tack nut washer to stud so washer will remain against waler while the opposite side nut is being installed.)

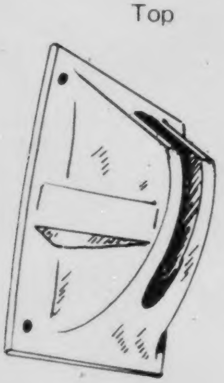
FIGURE 15


Nut Washer
8d Duplex Nail

3. Install opposite side washer over tie and tack to waler

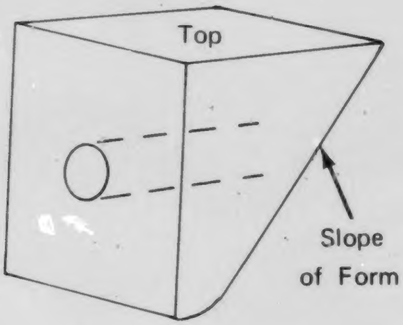
   (NOTE: Either type of washer may be used. See Figures 16a and 16b.)

FIGURE 16a



Malleable Batter Washer

FIGURE 16b


Top
Slope
of Form

Wood Washer

JOB SHEET #2

4. Install nuts on all ties

   (NOTE: Use wing nut with malleable washer and nut washer with wood washer. See Figures 17a and 17b.)

FIGURE 17a

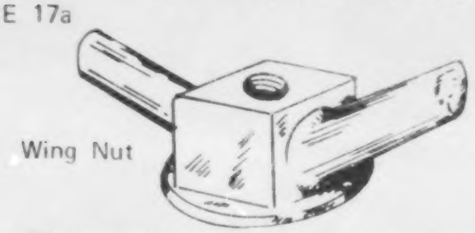
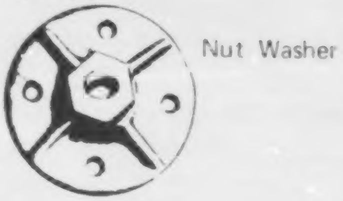


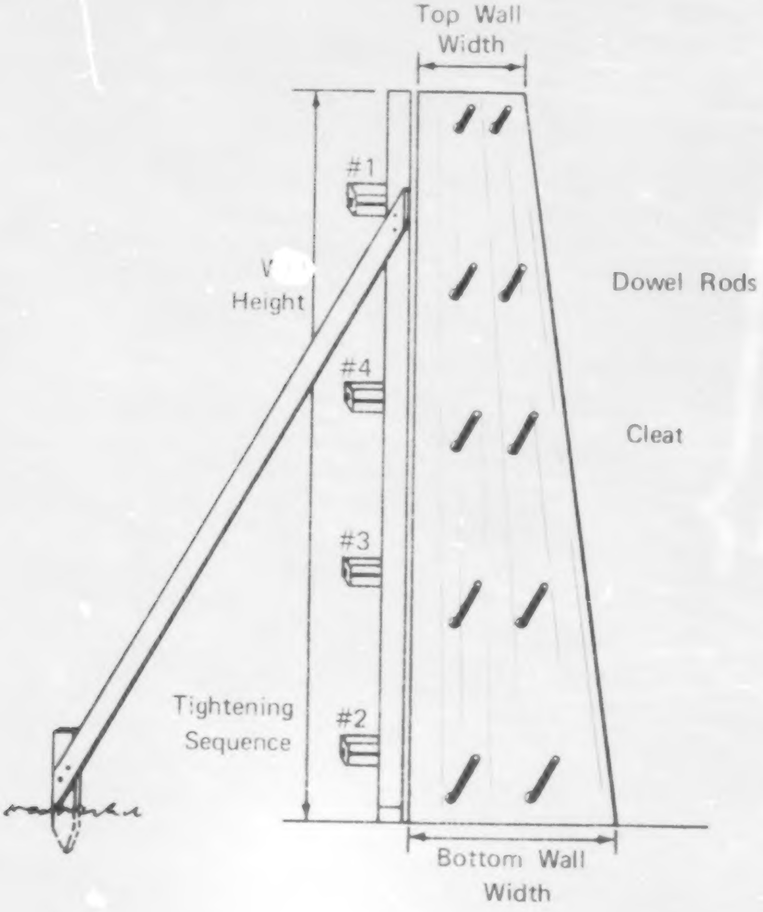
FIGURE 17b



5. Tighten all nuts in the order shown (Figure 18)

   (NOTE: Nuts should be pulled up snugly, but avoid pulling spreaders into sheathing by drawing nuts too tightly. Vertical end rows at bulkhead can be drawn tightly; this will help hold the bulkhead.)

FIGURE 18

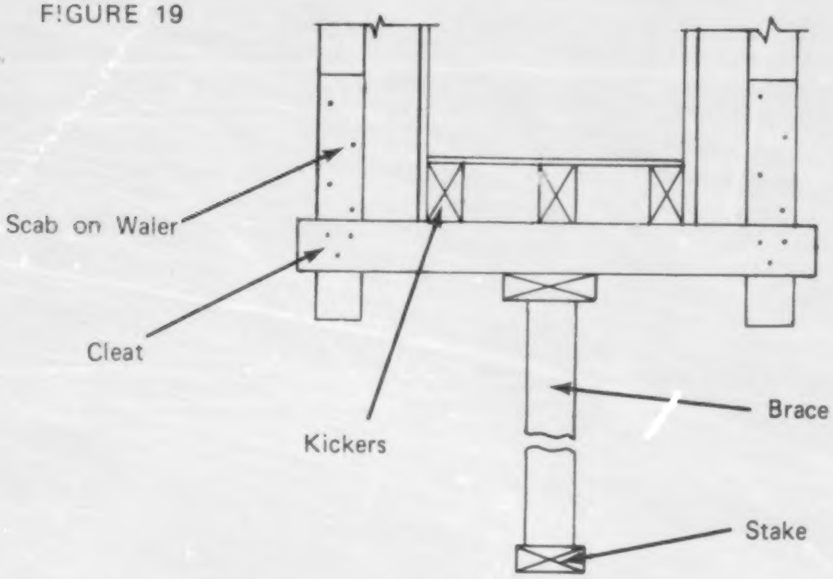

Top Wall Width
#1
W[illegible] Height
Dowel Rods
#4
Cleat
#3
Tightening Sequence
#2
Bottom Wall Width

JOB SHEET #2

I. Install additional support for bulkhead (if needed) (Figure 19)

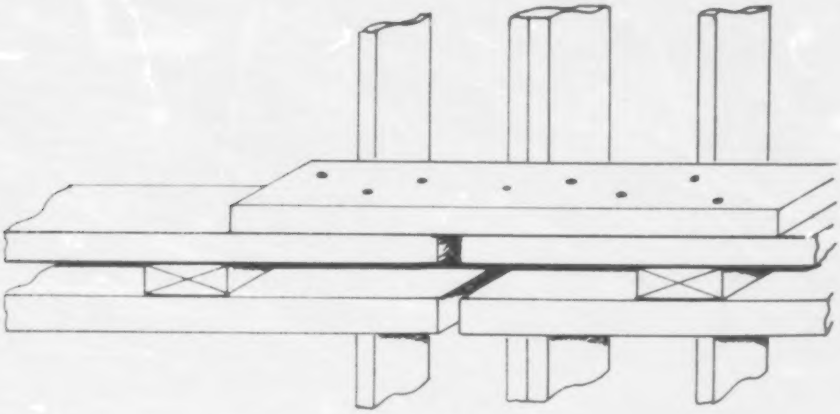
(NOTE: The pressure on the bulkhead is the same as on the form.)

FIGURE 19


Scab on Waler
Cleat
Kickers
Brace
Stake

J. Nail scabs over all waler joints (Figure 20)

FIGURE 20



WALL FORMS
UNIT IV

JOB SHEET #3--CONSTRUCT CIRCULAR WALL FORMS BUILT IN PLACE

I. Tools and materials

A. Tools

1. Electric handsaw
2. Crosscut handsaw
3. Claw hammer, 16 ounce or larger
4. Sledge hammer
5. Steel tape measure, 100 foot
6. Tape measure, 12 or 16 foot
7. Level, hand, 30"
8. Builder's level
9. Electric drill and bits
10. Chalk line
11. Wrench, adjustable, 16"
12. Plumb bob
13. Framing square
14. String line

B. Materials

1. Stakes
2. Sheathing
3. Spreaders
4. Form ties
5. 2 x 4's or 2 x 6's for braces and studs

JOB SHEET #3

6. Nails
    a. 8d duplex
    b. 16d duplex
    c. 6d common
    d. 16d common
    e. 8d common
7. 2 x 12 for segmental template ring
8. 1 x 4's

II. Procedure

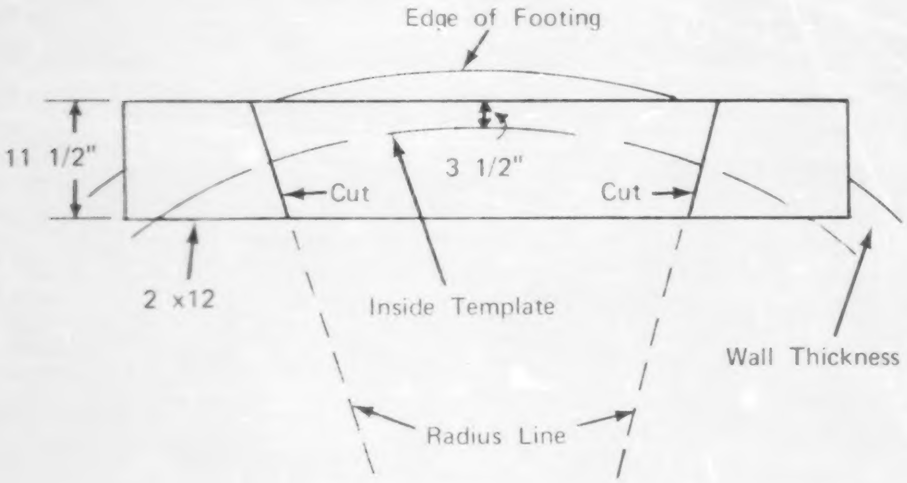
A. Determine height of wall and radius from plan

B. Measure radius from center point to lay out circumference of wall

(NOTE: Lay out both inside and outside wall lines.)

C. Lay out segmental template (Figure 1)

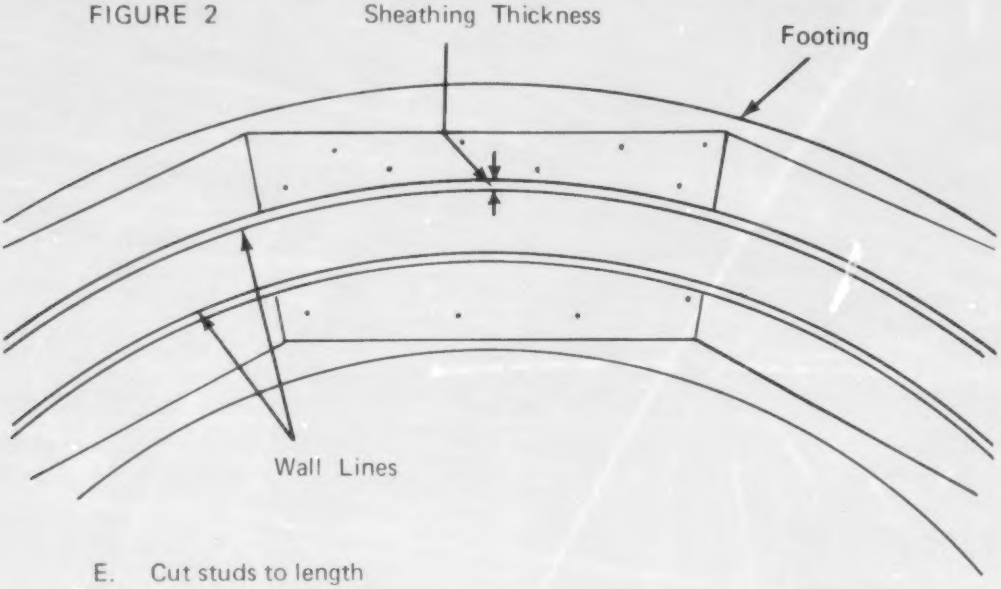
FIGURE 1


Edge of Footing
11 1/2"
3 1/2"
Cut
Cut
2 x12
Inside Template
Wall Thickness
Radius Line

JOB SHEET #3

D. Secure base templates to footing (Figure 2)

FIGURE 2

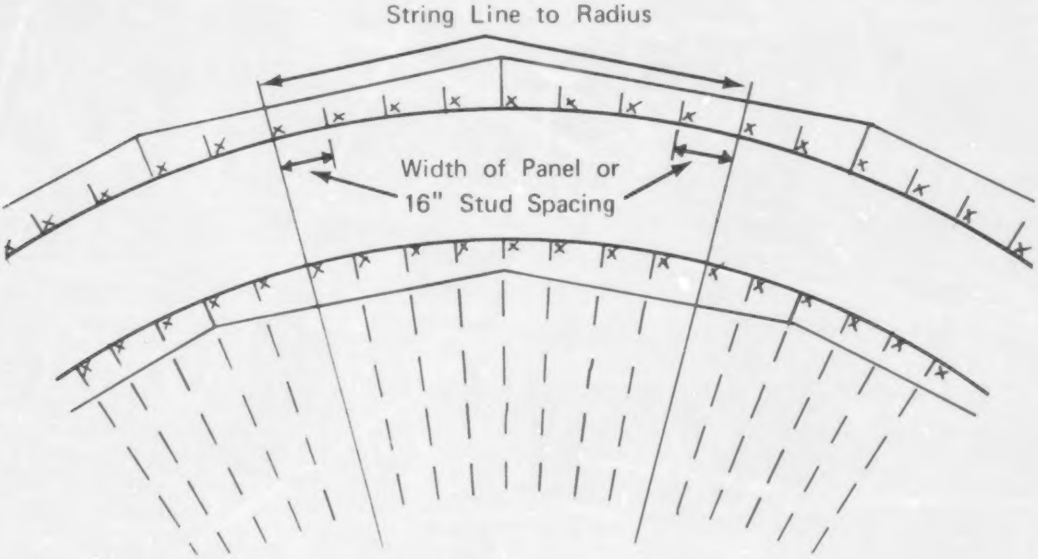

Sheathing Thickness
Footing
Wall Lines

E. Cut studs to length

F. Lay out stud spacing on both templates (Figure 3)

(NOTE: Set inside form first.)

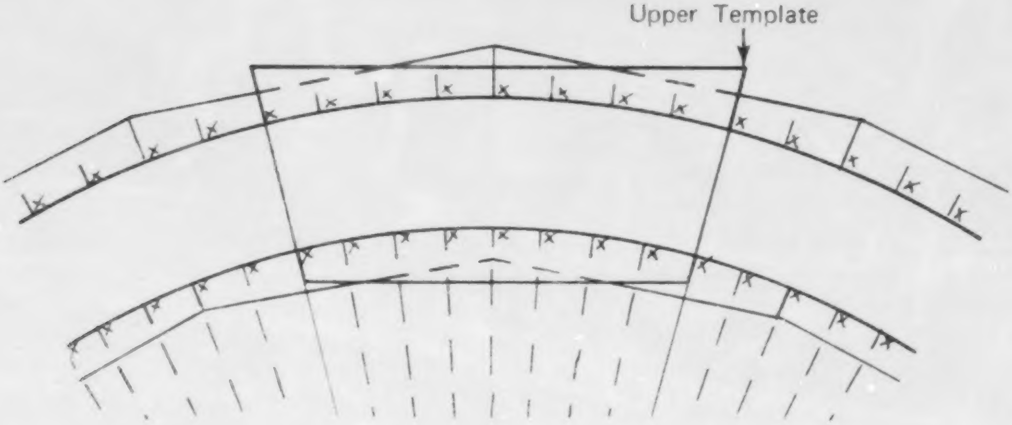
FIGURE 3


String Line to Radius
Width of Panel or
16" Stud Spacing

JOB SHEET #3

G. Tack upper segmental templates to base plate and transfer stud layout (Figure 4)

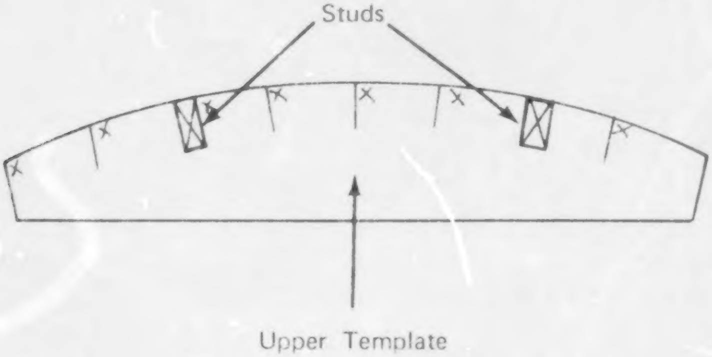
FIGURE 4


Upper Template

H. Nail two studs to an upper segment of template (Figure 5)

(NOTE: Stagger segment joints.)

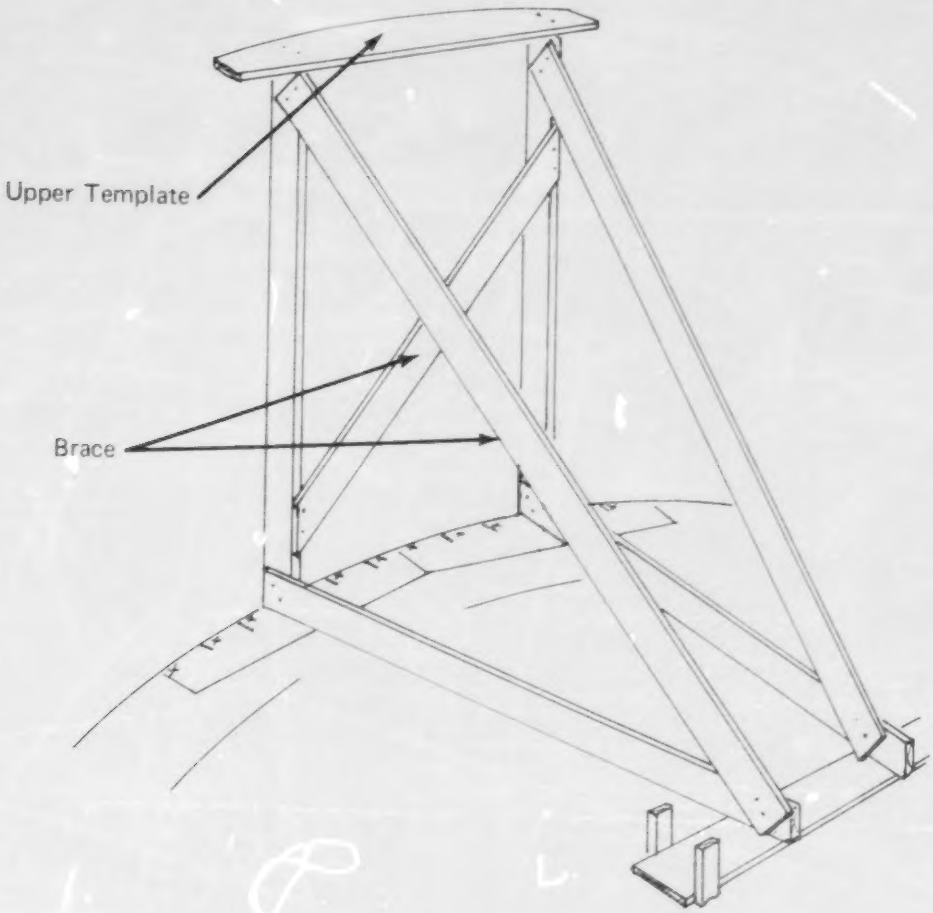
FIGURE 5


Studs
Upper Template

JOB SHEET #3

I. Stand unit in position; then plumb and brace (Figure 6)

FIGURE 6



J. Nail intermediate studs to upper and lower templates

K. Continue erection as outlined in steps H, I, and J

L. Nail scabs across joints of upper template

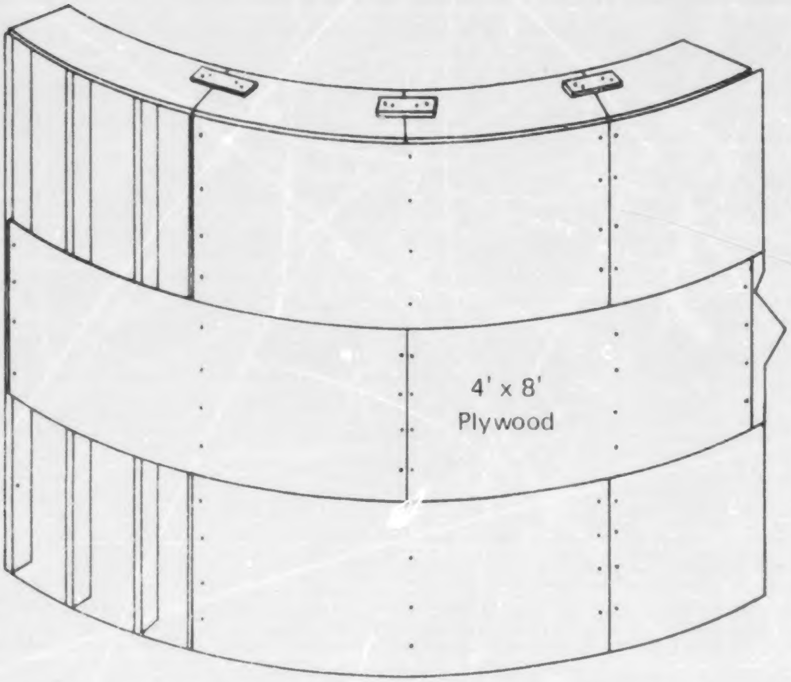
(NOTE: This may be done as erection progresses around the circle.)

JOB SHEET #3

M. Nail on sheathing (Figures 7a and 7b)

(NOTE: Sheathing may be plywood or 1 x 6 boards. If an architectural finish is desired, cover the 1 x 6 board with ply or hardboard.)

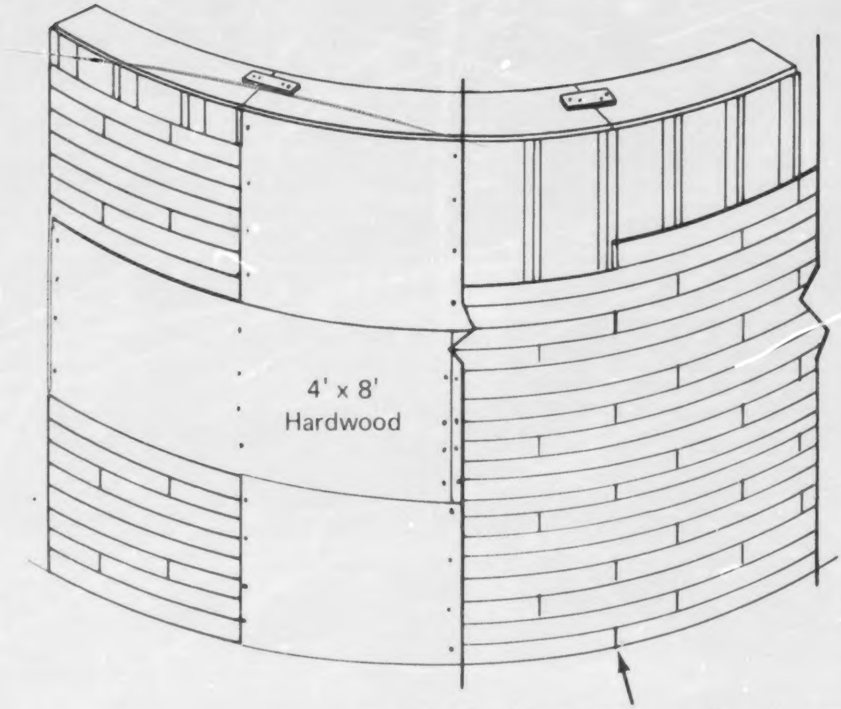
FIGURE 7 a



(NOTE: Use 1 x 6 square edge only when it will be covered.)

JOB SHEET #3

FIGURE 7b

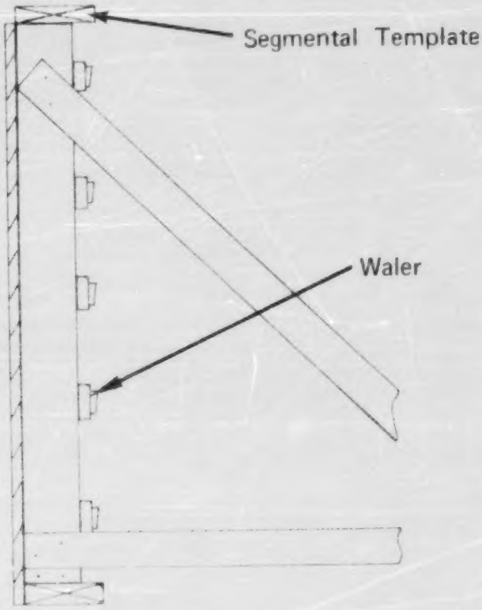

4' x 8'
Hardwood
1 x 6 Square Edge or Tongue and Groove

JOB SHEET #3

N. Install inside walers (Figure 8)

(NOTE: Use the thickest material that springs to the circumference for walers. A double thickness of one-inch material may be used.)

FIGURE 8



O. Drill holes for form ties

(NOTE: Place ties as close to studs as possible.)

P. Build and install all pockets, sleeves, or other blockouts needed in the finished wall

(NOTE: Reinforcing bars, if called for, will be installed at this time.)

Q. Place form ties through inside wall and waler; secure with tie holder

R. Sheath and stud outside form

(NOTE: Prebuilt panels may be used for outside forms. Narrow vertical panels work best. The width of the panels should be in direct relationship to the stud spacing.)

1. Attach studs to each panel
2. Drill tie holes

(NOTE: Make sure tie holes line up with inside form on radius line.)

JOB SHEET #3

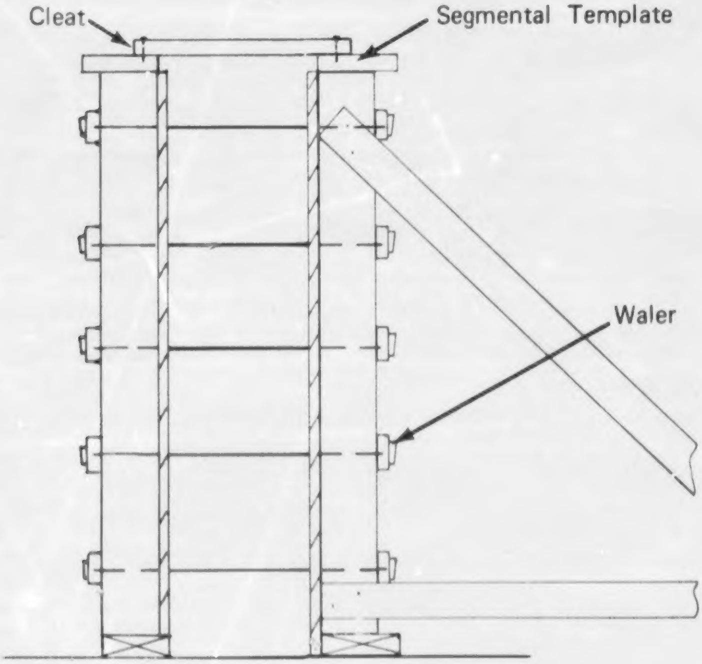
3. Stand panel up and thread in ties

4. Nail upper template to studs

5. Nail cleat across the top to hold panels vertically (Figure 9)

   (NOTE: After a number of panels have been erected, waler may be installed and tie holders secured to ties.)

FIGURE 9



S. Continue erection as outlined in steps 1 through 5 above

WALL FORMS
UNIT IV

JOB SHEET #4--CONSTRUCT PANEL FORMS

I. Tools and materials

A. Tools

1. Electric handsaw
2. Crosscut handsaw
3. Claw hammer, 16 ounce or larger
4. Sledge hammer
5. Tape measure, 100 foot
6. Tape measure, 12 or 16 foot
7. Level, hand, 30"
8. Builder's level
9. Electric drill and bits
10. Chalk line
11. Powder nailer
12. String line
13. Plumb bob
14. Framing square

B. Materials

1. Stakes
2. 2 x 4's or 2 x 6's for studs and plate
3. Sheathing, plyform
4. Plank, 2 x 10 (for jig table)
5. Form ties and holders for walls and pilasters

JOB SHEET #4

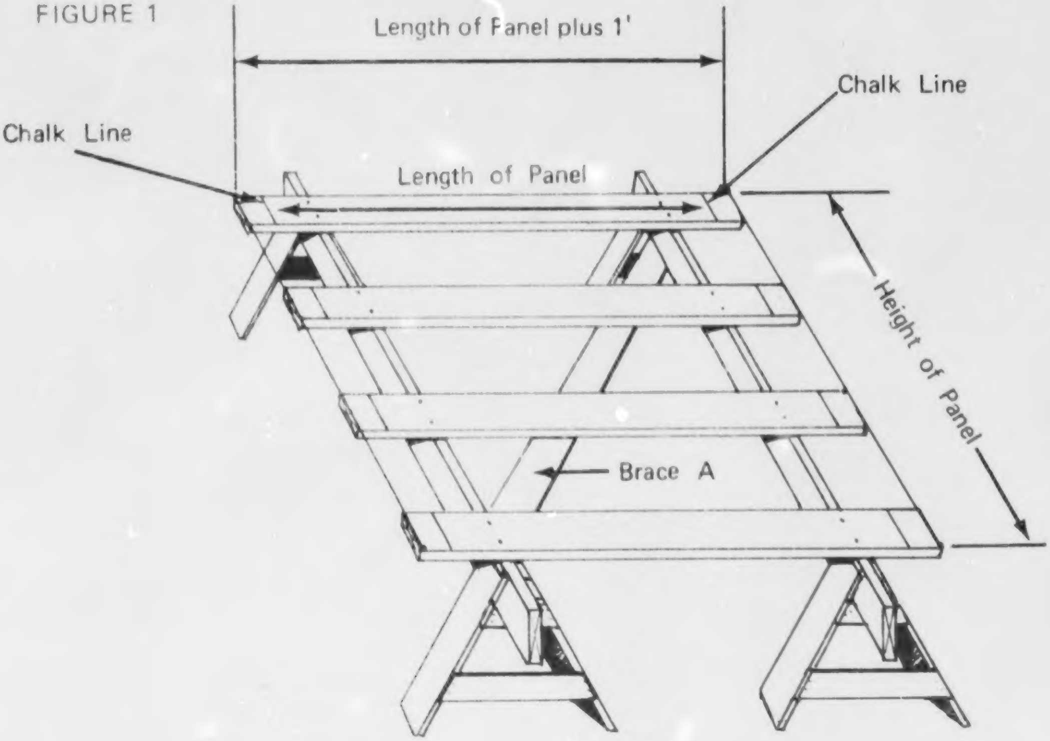
6. Nails
   a. 16d duplex
   b. 6d cement-coated
   c. Concrete
7. Form oil

II. Procedure

A. Determine height, width, and quantity of panels needed

B. Build a jig table (Figure 1)

FIGURE 1


Length of Panel plus 1'
Chalk Line
Chalk Line
Length of Panel
Height of Panel
Brace A

1. Secure or build horses at a convenient work height (usually two feet)
2. Lay plank across the horses and nail

   (NOTE: The platform should be a little larger than the panel.)
3. Check for square and nail brace A (Figure 1)

JOB SHEET #4

4. Lay out stud spacing on both outside planks (Figure 2)

FIGURE 2

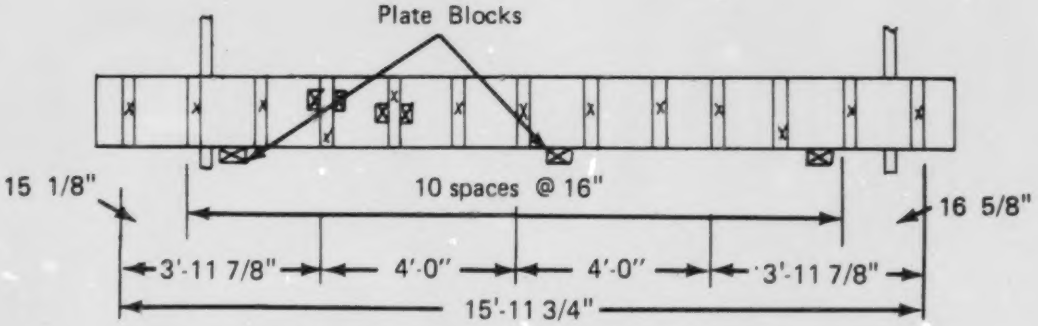
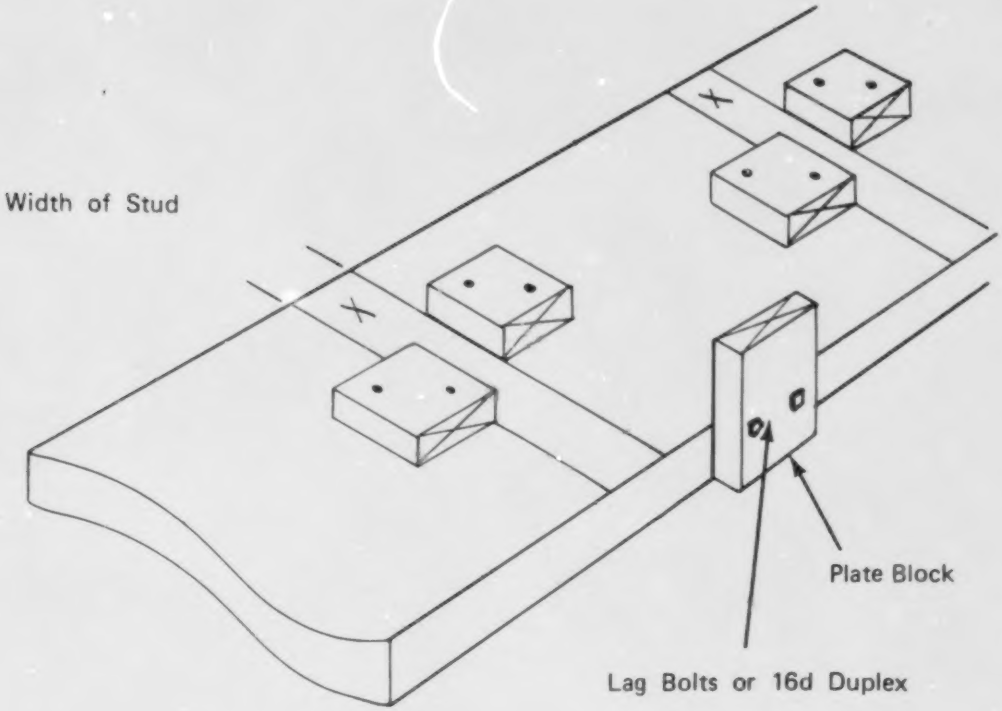


Plate Blocks
15 1/8"
10 spaces @ 16"
16 5/8"
3'-11 7/8"
4'-0"
4'-0"
3'-11 7/8"
15'-11 3/4"

5. Nail jig blocks to platform, one on each side of stud layout (Figure 3)

FIGURE 3


Width of Stud
Plate Block
Lag Bolts or 16d Duplex

JOB SHEET #4

6. Nail or bolt plate blocks on one edge of plank

   (NOTE: The jig is now ready to use.)

C. Build panels

1. Cut plates and studs to correct length

   (NOTE: Accuracy is very important in all phases of panel building.)

2. Make template for panel lock bolt holes (Figures 4a and 4b)

FIGURE 4a

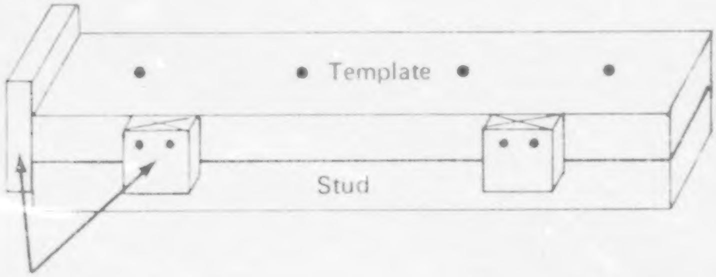
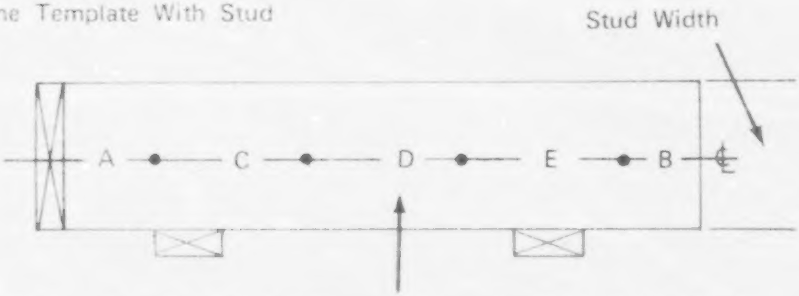


FIGURE 4b



Make Spaces A and B Equal Distance From the End of the Stud.
Make Spaces C, D, and E Equal Distance From the End of the Stud.

3. Drill panel lock bolt holes in end studs

   (NOTE: Pick straight studs.)

4. Place stud in jig

   (CAUTION: Place predrilled studs at panel ends.)

5. Nail plates to studs

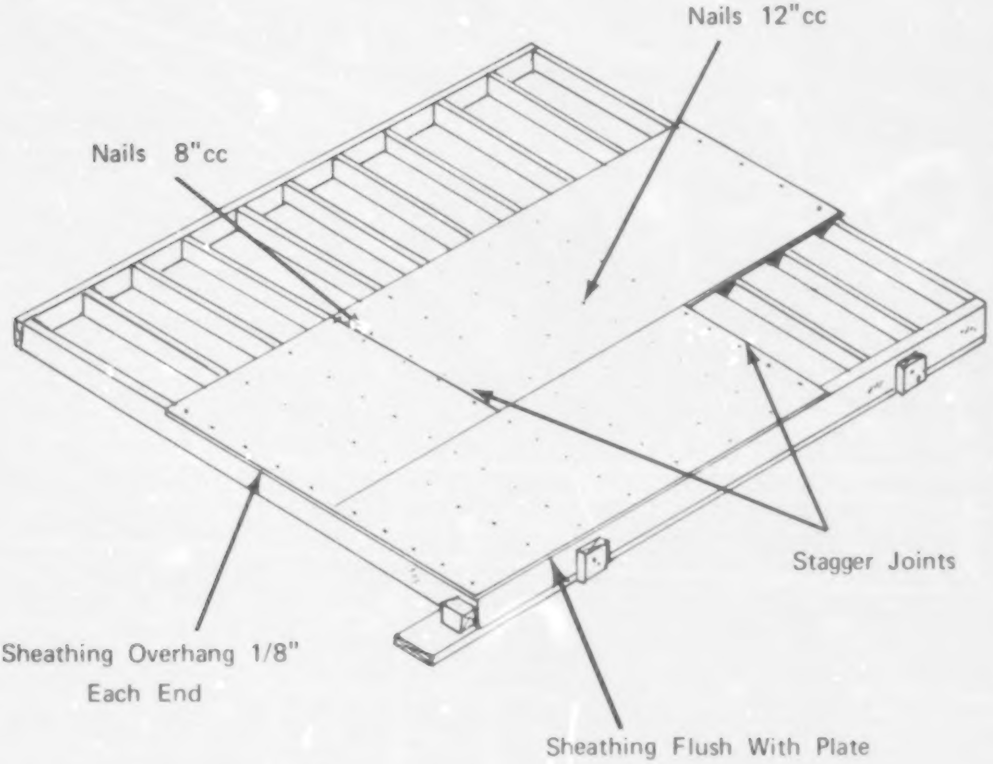
6. Pull plate down against plate blocks

JOB SHEET #4

7. Sheath panel (Figure 5)

(NOTE: Plywood may be installed vertically with staggered joints.)

FIGURE 5


Nails 12"cc
Nails 8"cc
Stagger Joints
Sheathing Overhang 1/8" Each End
Sheathing Flush With Plate

a. Tack first sheet with 1/8" overhang on ends and flush with bottom plate

b. Tack all sheets on panel; check fit

c. Nail securely as shown in Figure 5

(NOTE: Use cement-coated, ring shank, or other types of nails with good holding power.)

JOB SHEET #4

8. Determine tie spacing vertically and horizontally using table in Figure 6

FIGURE 6

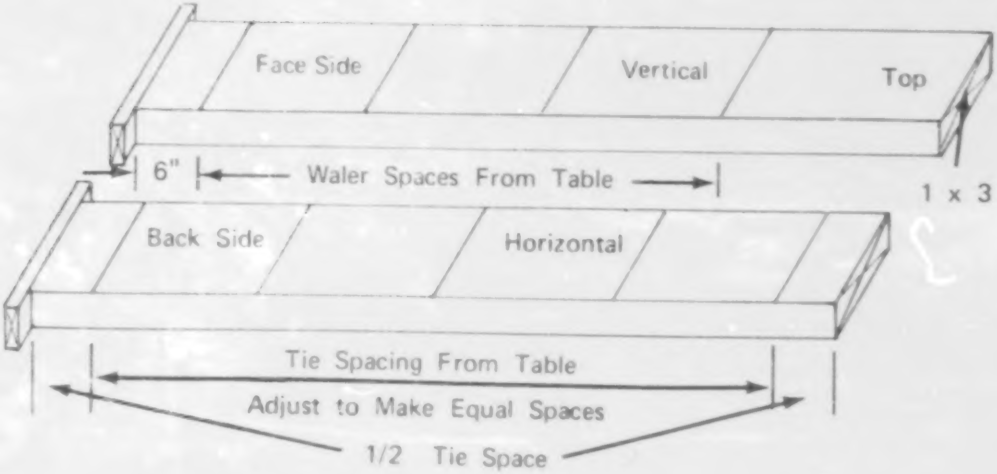
At 50° Temperature				For ¾" Sheathing, 2x4 Studs, Double 2x4 Walers	At 70° Temperature			
2'	3'	4'	5'	Rate of Pour (Vertical Feet per Hour)	2'	3'	4'	5'
21"	18"	18"	16"	Stud spacing for safe value of sheathing	24"	21"	18"	18"
30"	27"	24"	24"	Waler spacing for safe value of studs	33"	30"	27"	27"
30"	24"	24"	18"	Tie spacing for safe value of walers	36"	30"	27"	24"

(NOTE: Table calls for stud spacing of 18". When using plywood, it is recommended that 16" spacing be used to avoid waste. The spacing can be less than the spacing shown but should never be greater.)

9. Make tie spacing template (Figure 7)

(NOTE: Horizontal and vertical spacings can be laid out on the same template.)

FIGURE 7

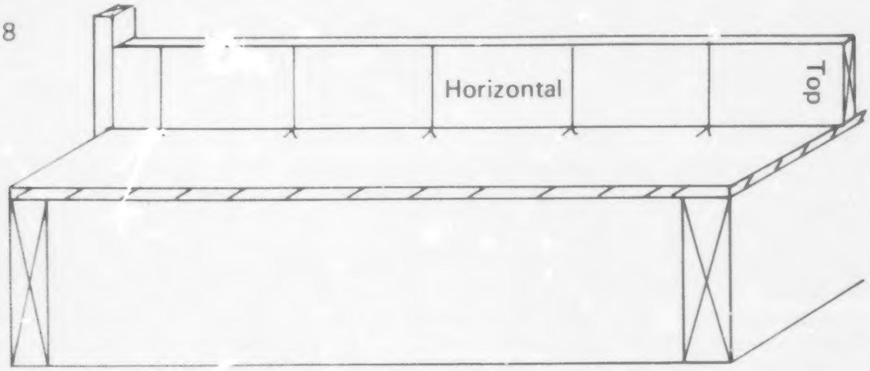

Face Side
Vertical
Top
6"
Waler Spaces From Table
1 x 3
Back Side
Horizontal
Tie Spacing From Table
Adjust to Make Equal Spaces
1/2 Tie Space

(CAUTION: Mark sides of template clearly to avoid error and speed up layout.)

JOB SHEET #4

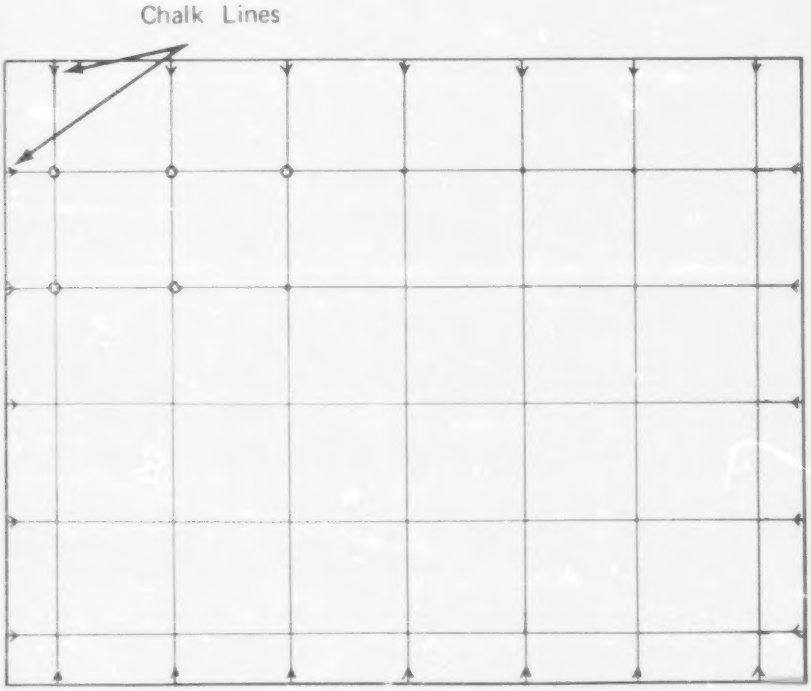
10. Mark tie spacing from template on four sides of the panel (Figure 8)

FIGURE 8


Horizontal
Top

11. Snap chalk lines to connect all vertical and horizontal points (Figure 9)

FIGURE 9


Chalk Lines

JOB SHEET #4

12. Drill tie holes at all points where chalk lines cross

    (NOTE: Size of hole is determined by size of tie. Tie should fit hole snugly to avoid loss of mortar.)

13. Build the required number of main filler and pilaster panels

D. Locate and set sole plates

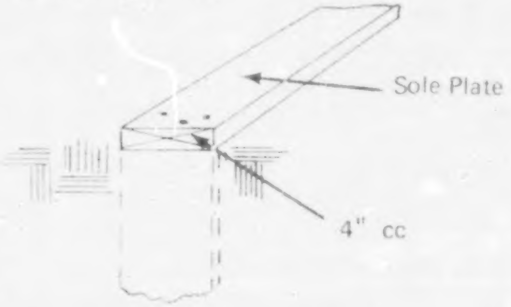
1. Transfer building lines from the batter boards

   (NOTE: Use plumb bob.)

   a. For setting on footings, establish corners and snap a chalk line on the footing at the wall line

   b. For setting without footings, drive stakes to support sole plate and panels (Figure 10)

FIGURE 10


Sole Plate
4" cc

2. Set sole plates (Figures 11a and 11b)

   (NOTE: Sole plates may be set on the wall line as in Figure 11a or 3/4" back of the wall line as shown in Figure 11b.)

FIGURE 11a

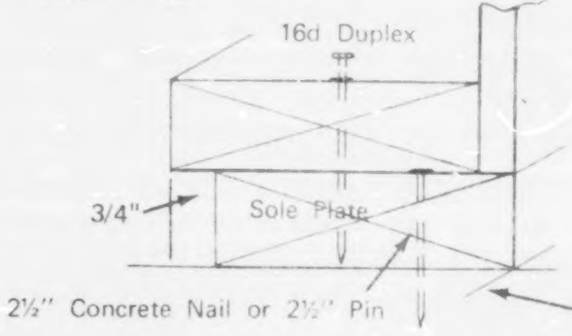
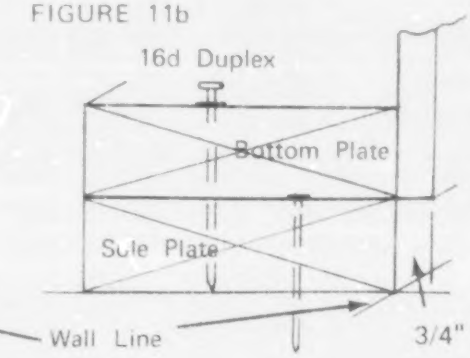

16d Duplex
3/4"
Sole Plate
2½" Concrete Nail or 2½" Pin

FIGURE 11b


16d Duplex
Bottom Plate
Sole Plate
Wall Line
3/4"

JOB SHEET #4

E. Erect first side panels

1. Establish location of first panel

   (NOTE: This will assure that tie holes in the two sides are lined up and that filler panels will fit.)

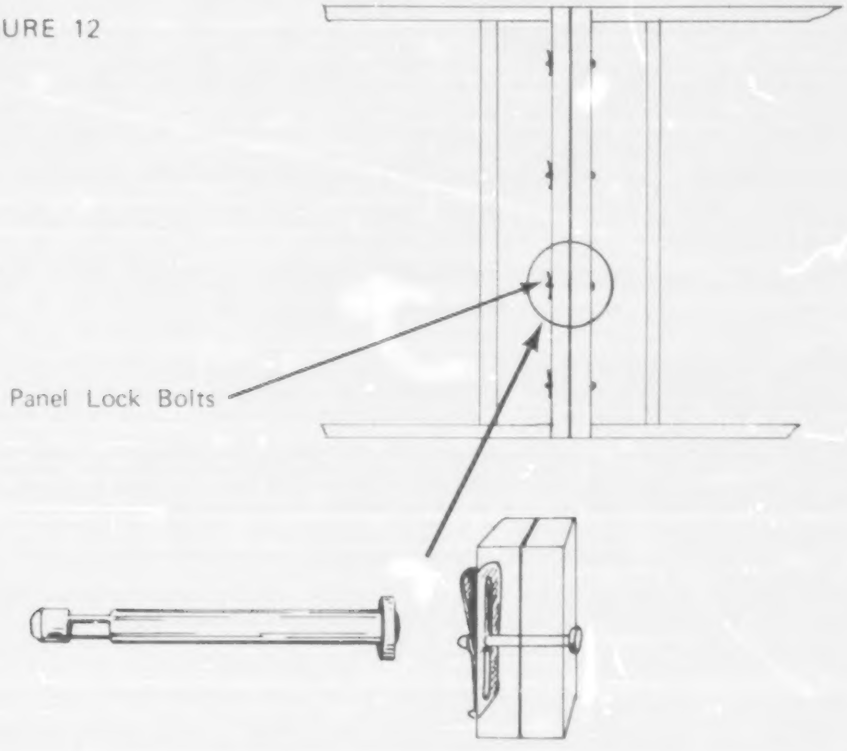
2. Place the first panel on the wall line and secure to sole plate as shown in Figure 11a or 11b

   (NOTE: Attach temporary brace to hold panel plumb.)

3. Set the adjacent panel in place and secure to first panel with panel lock bolts (Figure 12)

   (NOTE: If panel lock bolts are not available, use machine bolts with washers.)

FIGURE 12



4. Line bottom of panel and nail to sole plate as shown in Figure 11a or 11b

5. Repeat steps 1, 2 3, and 4 to continue erection

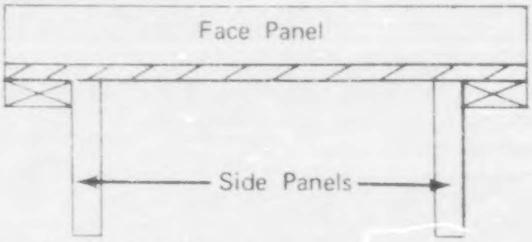
JOB SHEET #4

6. Erect pilaster panels

   a. Erect main or filler panel on each side of the pilaster opening

   b. Nail pilaster side panels to face panel (Figure 13)

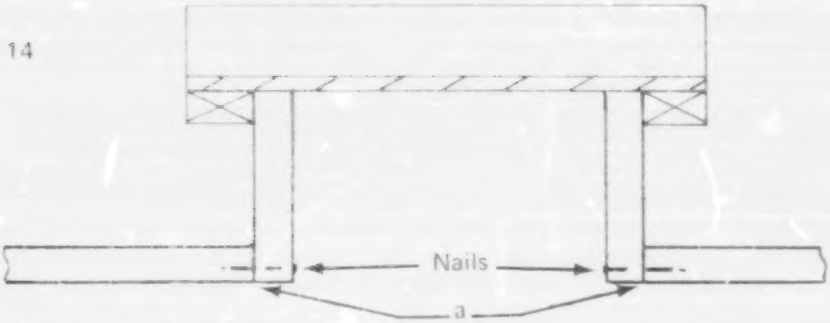
FIGURE 13


Face Panel
Side Panels

   c. Stand pilaster form in place and nail side panels to wall panels (Figure 14)

   (NOTE: Make points at "a" flush.)

FIGURE 14



7. Install waler blocks or brackets (Figures 15a and 15b)

   (NOTE: Be sure horizontal tie holes line with waler slot.)

8. Set walers on supports and tack to stud as shown in Figure 15a or 15b

9. Place ties through form and waler; secure with tie holder

FIGURE 15a

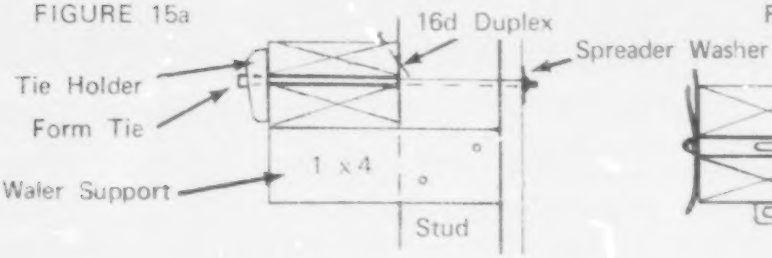
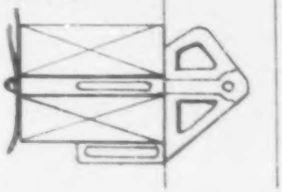

16d Duplex
Spreader Washer
Tie Holder
Form Tie
Waler Support
1 x 4
Stud

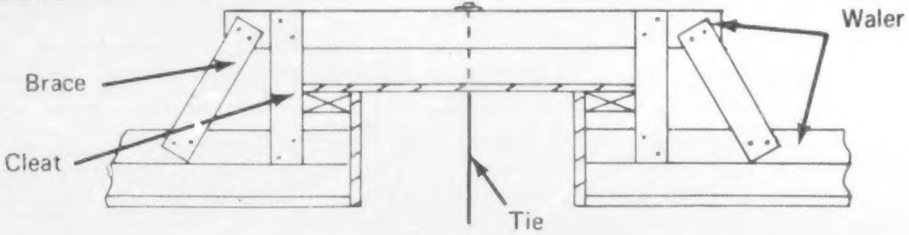
FIGURE 15b



JOB SHEET #4

10. Install waler and brace pilaster (Figure 16)

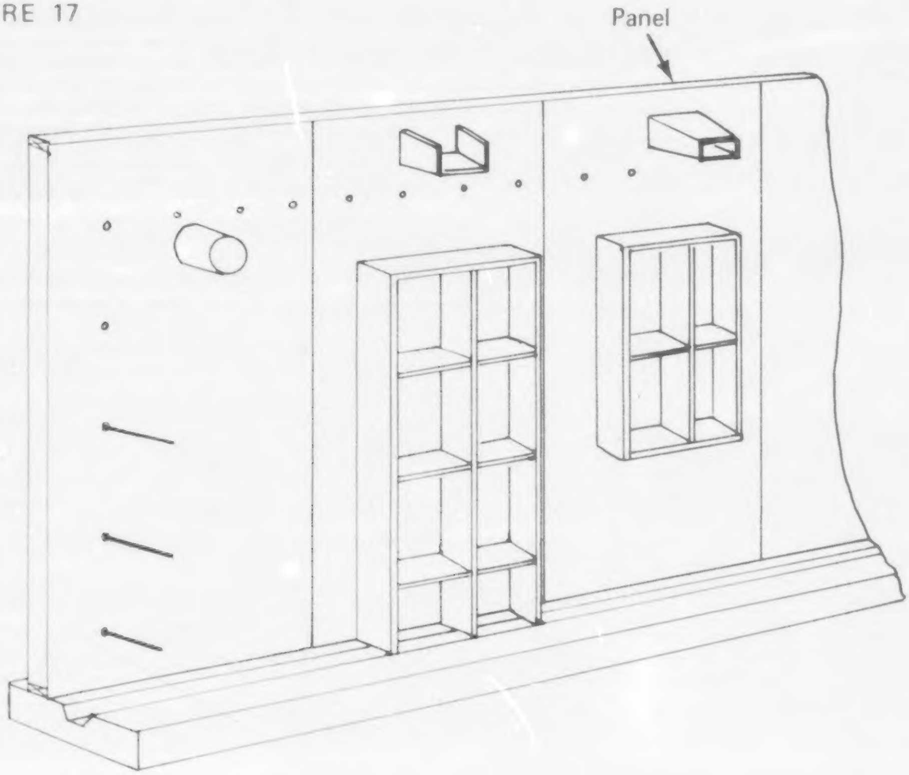
FIGURE 16


Waler
Brace
Cleat
Tie

11. Install all sleeve pockets or blockouts (Figure 17)

(NOTE: Form oil must be applied before rebars are installed.)

FIGURE 17



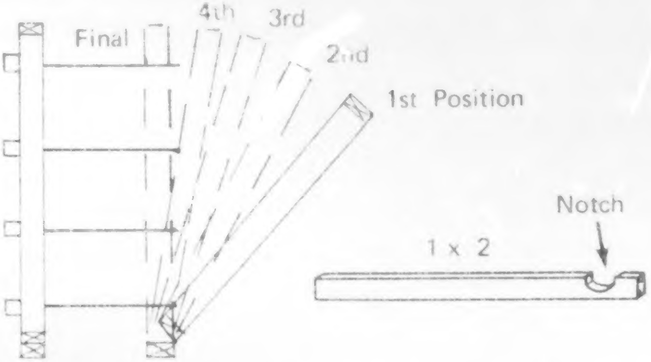
JOB SHEET #4

F. Erect second side panels

1. Stand panel on sole plate and, when positioned, tack to sole plate (Figure 18)

   (NOTE: Thread ties through predrilled holes by setting panel on sole plate and tipping into place. A notched 1 x 2 will assist in lining up the ties with the holes.)

FIGURE 18

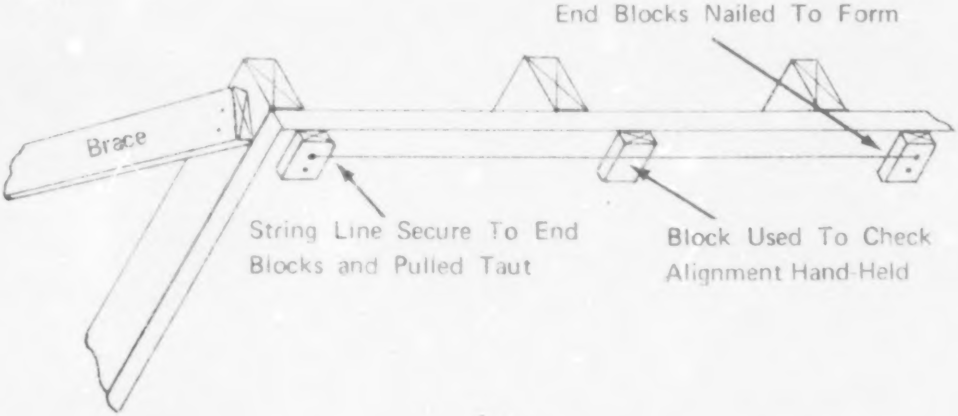

Final
4th
3rd
2nd
1st Position
Notch
1 x 2

2. Place a short waler over one of the upper ties and secure panel with tie holder
3. Repeat steps 1 and 2 to continue erection
4. Install waler supports as shown in Figure 15a or 15b
5. Set walers on supports, place tie holders on ties, and tighten

G. Align forms (Figure 19)

(NOTE: Align form with braces placed as needed along form.)

FIGURE 19


End Blocks Nailed To Form
Brace
String Line Secure To End Blocks and Pulled Taut
Block Used To Check Alignment Hand-Held

WALL FORMS
UNIT IV

JOB SHEET #5--CONSTRUCT SLIP FORMS

I. Tools and materials

A. Tools

1. Electric handsaw
2. Crosscut handsaw
3. Claw hammer, 16 oz or larger
4. Tape measure, 100 foot
5. Measuring tape, 12 or 16 foot
6. Level, hand
7. Electric drill and bits
8. Plumb bob
9. Builder's level

B. Materials

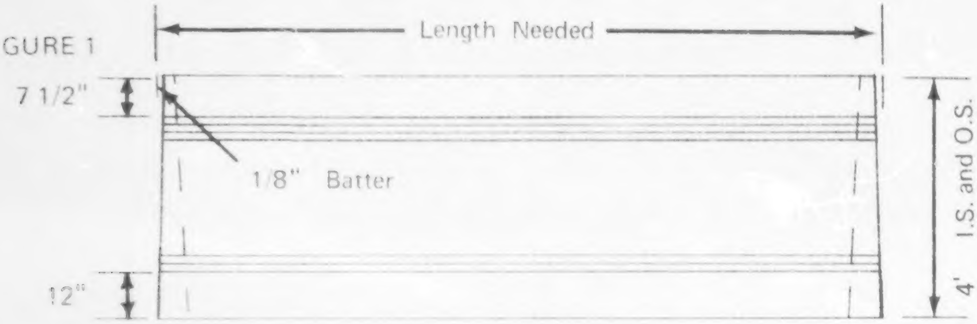
1. Hanger and tie rods, 5/8 inch
2. Yokes, 3 x 12's
3. Walers, 2 x 8's, 3 top and 2 bottom
4. Truss cords, 2 x 10's
5. Truss web, 2 x 6's
6. Scaffold hangers, 2 x 4's
7. Guardrails, 2 x 6's and 2 x 4's
8. Joist, 2 x 8's
9. Jacks and jack rod
10. Water levels
11. Sheathing, 3/4" plyform or 1 x 6 tongue and groove
12. Decking, 1 x 8, 1 x 10, or plywood
13. Pump and control panel

JOB SHEET #5

II. Procedure

A. Build form panels (Figure 1)

FIGURE 1



(NOTE: Inside form is shown in dotted lines. Batter outside forms 1/8" on both ends. For inside forms, batter opposite direction to make form 1/4" wider at the bottom.)

1. Cut plywood to size

   (NOTE: Grain will run vertically.)

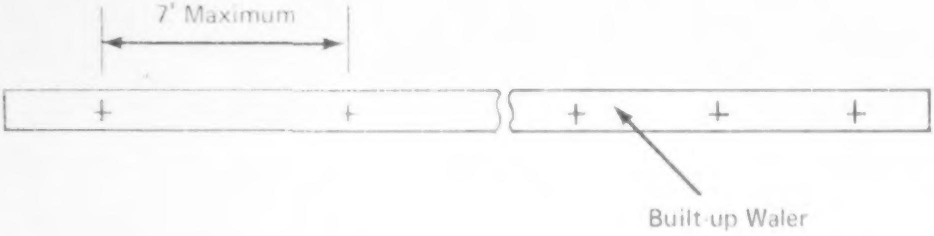
2. Fabricate walers

   (NOTE: Do not use spacers as for a wall form but nail them tightly to each other using 16d common nails. Use three ply top walers and two ply bottom walers.)

3. Drill holes for hanger rods (Figure 2)

   (NOTE: Hanger rods will be installed at each lifting yoke.)

FIGURE 2



4. Nail plyform sheathing to walers

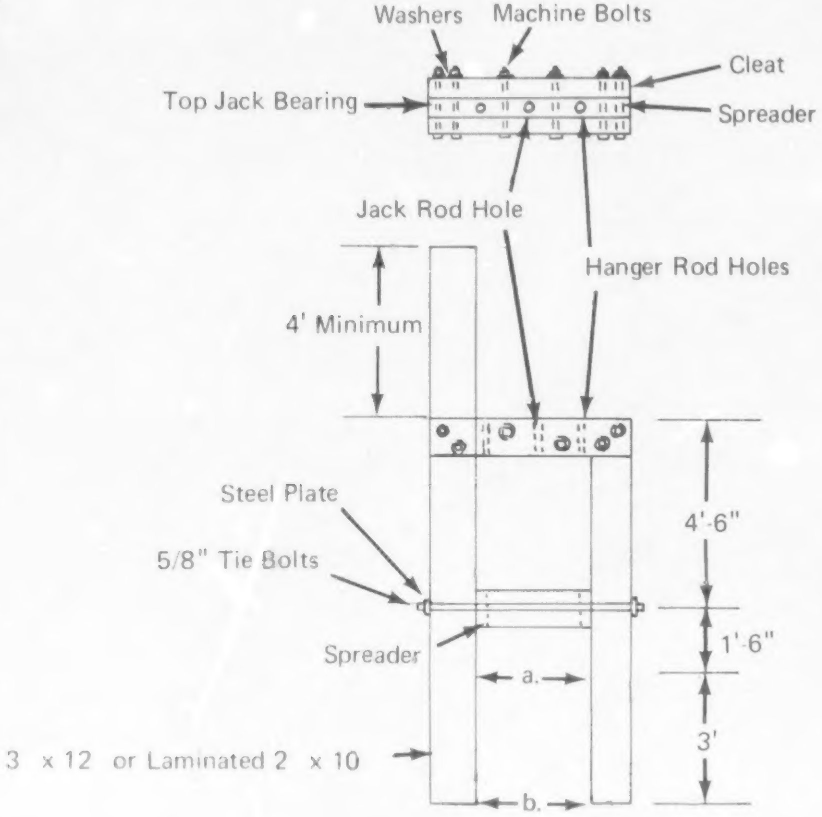
   (NOTE: See Figure 1 for waler spacing.)

JOB SHEET #5

B. Build yokes (Figure 3)

(NOTE: A vertical rebar template may be secured to the higher outside leg of the yoke and deck handrail.)

FIGURE 3


Washers
Machine Bolts
Cleat
Top Jack Bearing
Spreader
Jack Rod Hole
Hanger Rod Holes
4' Minimum
Steel Plate
5/8" Tie Bolts
4'-6"
1'-6"
Spreader
a.
3'
3 x 12 or Laminated 2 x 10
b.

a. = Thickness of wall plus form, including walers.

b. = Dimension a plus 1 1/2" for adjustment wedging to assure batter and wall thickness.

1. Lay out and cut material to size
2. Drill hanger bolt and jack rod holes in spreaders

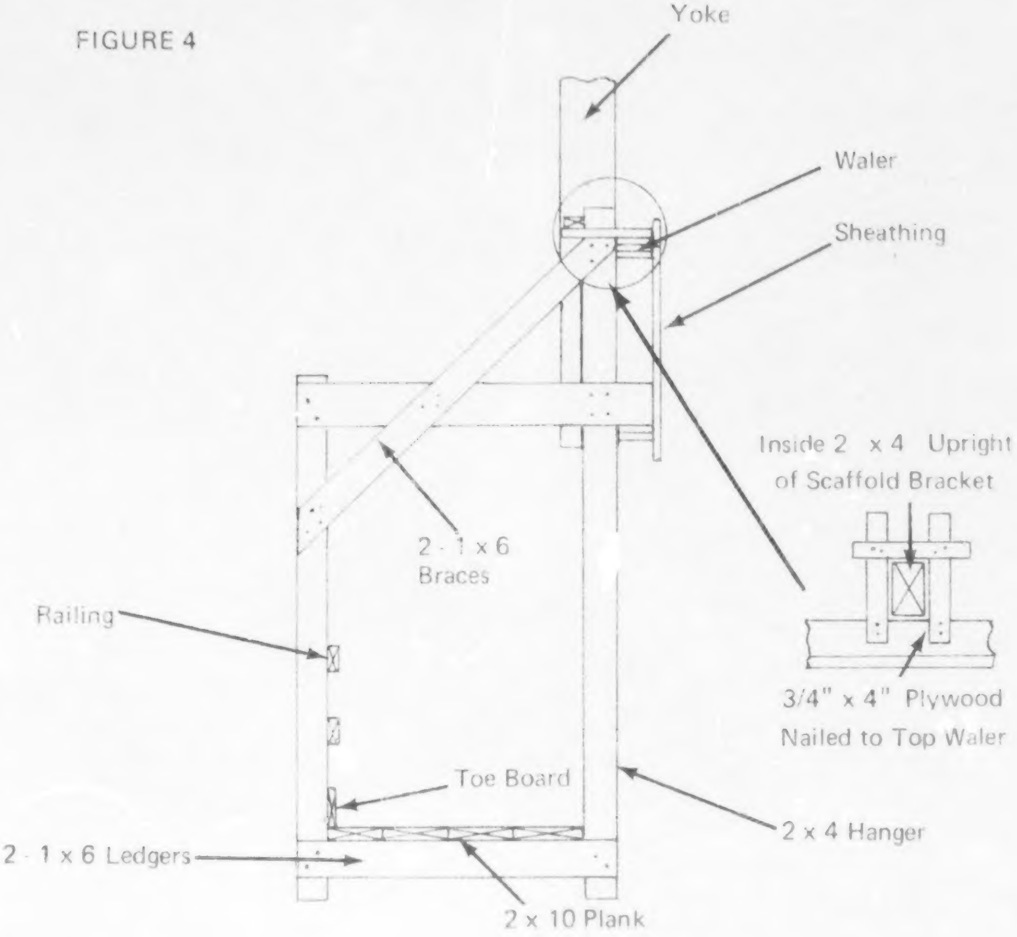
   (NOTE: Locate holes accurately.)

3. Assemble yoke as shown in Figure 3

JOB SHEET #5

C. Build scaffold hangers (Figure 4)

FIGURE 4


Yoke
Waler
Sheathing
Inside 2 x 4 Upright of Scaffold Bracket
2 - 1 x 6 Braces
Railing
3/4" x 4" Plywood Nailed to Top Waler
Toe Board
2 x 4 Hanger
2 - 1 x 6 Ledgers
2 x 10 Plank

(NOTE: Plank and nails shall be installed after scaffold hangers are mounted on form. Inside scaffold hanger is made very similarly or hung from cable. See Figure 7.)

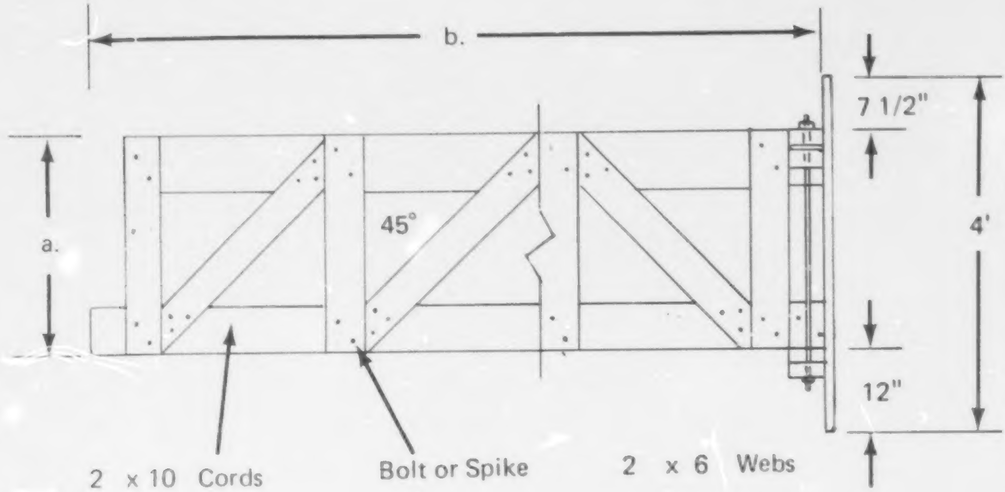
1. Lay out and cut material to length
2. Tack unit together
3. Drill bolt holes
4. Install bolts

   (NOTE: Be sure to use flat washers on both ends of bolts.)

JOB SHEET #5

D. Build working platform truss (Figure 5)

FIGURE 5



1. Lay out and cut material to length

   (NOTE: Length of truss and total height of pour will determine truss component sizes and method of fabrication.)

2. Assemble truss as shown in Figure 5

   (NOTE: Webs will be nailed or bolted to chords. Also, there are other methods of building the truss. Follow the shop drawing details.)

E. Erect inside forms and trusses

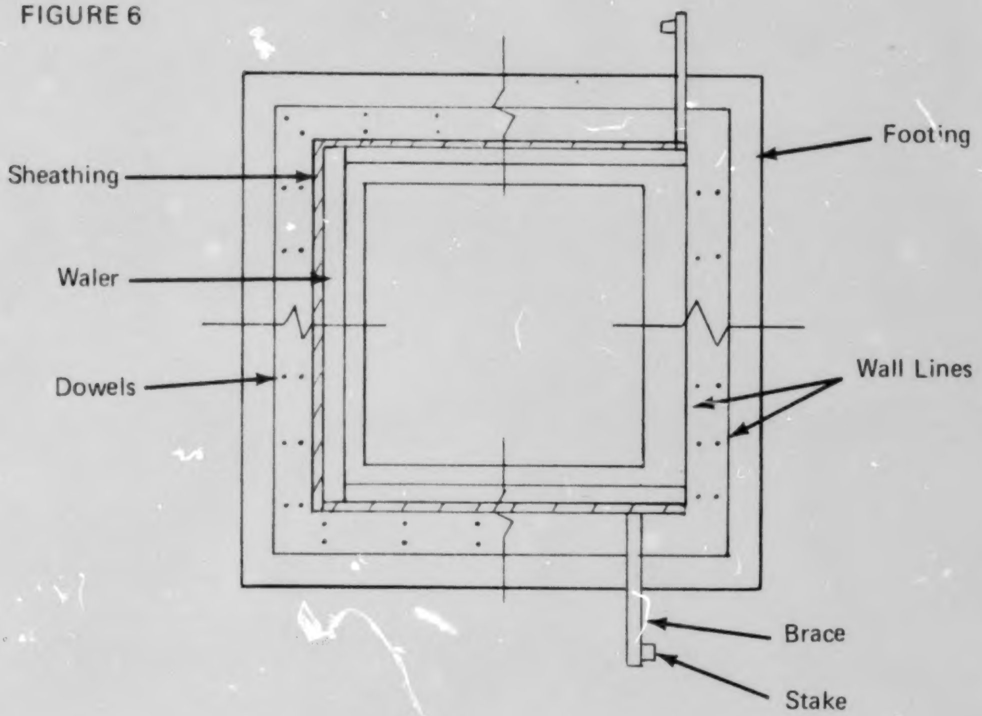
1. Snap chalk line on footing to establish wall line

JOB SHEET #5

2. Set inside forms on three sides

   (NOTE: Forms must be oiled before setting. See Figure 6.)

FIGURE 6


Footing
Sheathing
Waler
Dowels
Wall Lines
Brace
Stake

3. Install trusses

   a. Set truss on waler of end form

   b. Nail temporary leg to free end of truss to hold it level

      (NOTE: This is to hold the truss level until the next form is set.)

   c. Secure truss to waler

      (NOTE: See Figure 5.)

4. Set end form

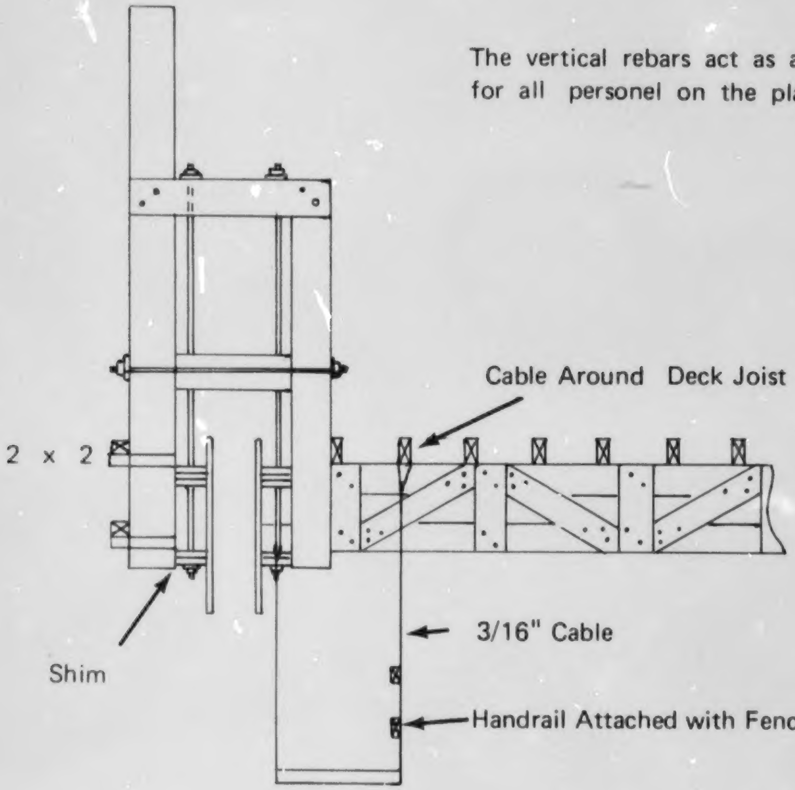
5. Check batter and alignment of form and secure trusses to walers

JOB SHEET #5

F. Erect outside form and yokes

(NOTE: Rebars can be more easily installed prior to erecting outside form. See Figure 7.)

FIGURE 7


2 x 2
Shim
Cable Around Deck Joist
3/16" Cable
Handrail Attached with Fence Staples

The vertical rebars act as a safety cage for all personel on the platform

1. Stand forms in position
2. Nail together at corners
3. Install yokes

JOB SHEET #5

4. Secure yokes to walers of inside and outside form
   a. Nail 2 x 2 to waler
   b. Check batter and spacing between forms for wall thickness
   c. Wood shim between waler and yoke or yoke and back 2 x 2 as required

G. Install hanger and jack rods

1. Thread hanger rods through hole in yoke and walers

   (NOTE: Use a plate washer on top and bottom of rod.)

2. Secure nut on bottom of rod

   (NOTE: Use double nut or lock washer so vibration does not loosen nuts.)

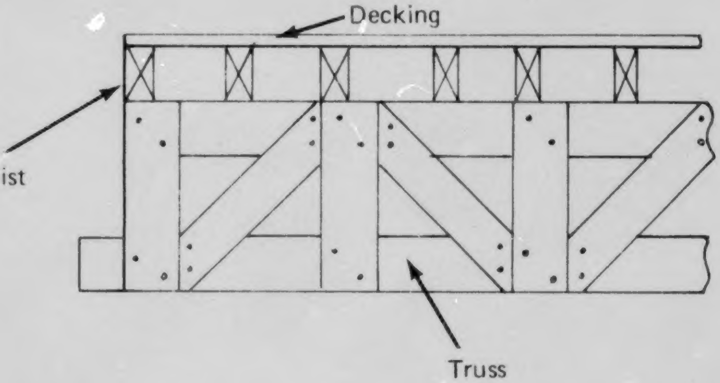
3. Thread jack rods through holes in yoke

   (NOTE: Make sure rod is seated on footing and plumb.)

H. Install deck joist and decking (Figure 8)

(NOTE: Decking can be 1 x 8, 1 x 10, or plywood.)

FIGURE 8



1. Install joist

   (NOTE: Align side of form parallel to truss before installing joist.)

2. Lay decking

   (NOTE: Leave holes in deck for access to inside scaffold; build a guardrail around hole.)

JOB SHEET #5

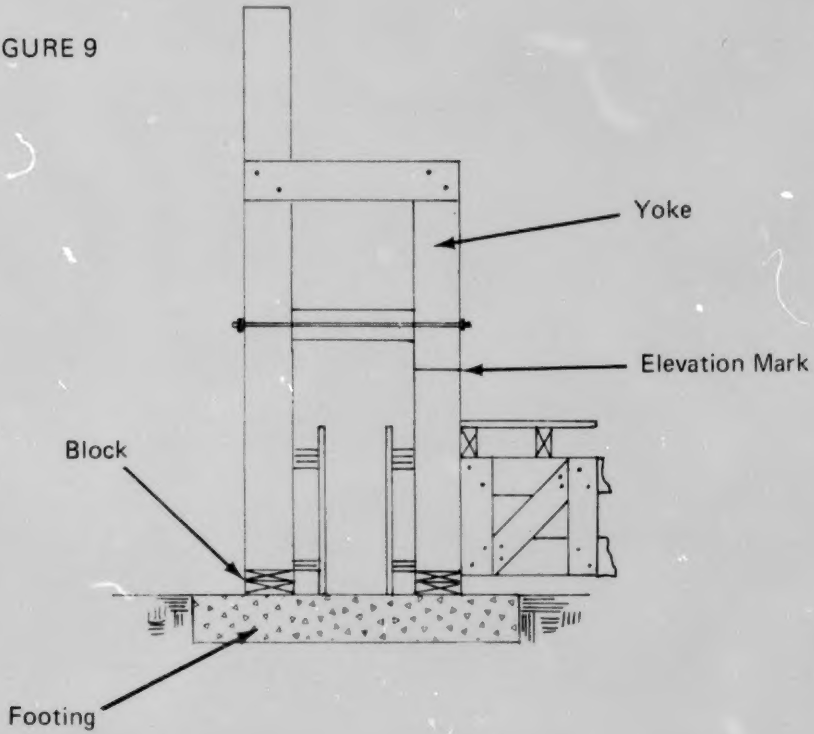
I. Install jacks, pump, and control panel

  1. Place jacks on jack rod
  2. Set control panel and pump in a central location
  3. Connect pump hoses to jacks

J. Install water level and elevation measuring tape

  1. Set up builder's level
  2. Establish HI from bench mark
  3. Level forms with wood supports from slab to bottom walers at each yoke
  4. Measure an elevation from deck at each yoke where water level and tape will be referenced (Figure 9)

FIGURE 9



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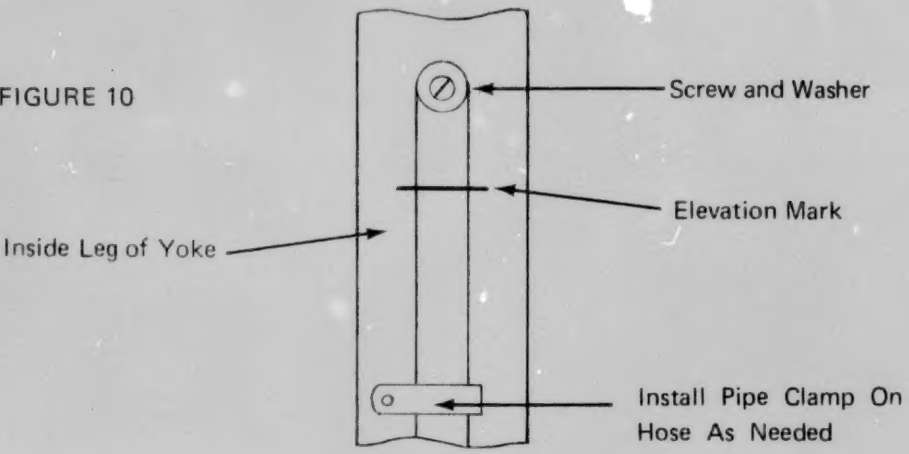
JOB SHEET #5

5. Secure water level to yoke (Figure 10)

FIGURE 10



(NOTE: If water switch is not used, connect other end of hose to another yoke.)

6. Secure measuring tape

   a. Level over from elevation mark to rebar or lifting rod

   b. Attach tape to rod or rebar

      (NOTE: Be sure measurement on tape corresponds with known elevation of mark.)

   c. Attach tape reel to yoke spreader

      (CAUTION: Keep tape taut.)

7. Secure plumb bob and line reel to platform; place plumb reference mark on footing

   (NOTE: An alternate method of plumbing the wall is with a prismatic transit with a permanent reference target on footing slab and bottom of form, or measure distance at bottom and shoot top distance to face of wall.)

K. Install scaffold hangers, rail, and plank

1. Stand O.S. scaffold hanger against walers as shown in Figure 4

2. Install rail

   (NOTE: The scaffold may be enclosed with chicken wire mesh for safety from falling tools of finishers.)

JOB SHEET #5

3. Install plank platform

   (NOTE: As the slip form rises, the walers will pick up the 1 x 6 hangers which can be nailed or bolted to the walers.)

4. Secure toe boards to uprights

5. Hang inside scaffold from joist as shown in Figure 7

   (NOTE: Diagonal 1 x 6 braces can be nailed from scaffold plank to joist to stop sway.)

L. Install splash board on top of outside form

(NOTE: Splash board may be 1 x 8 board or 1/4" plywood.)

WALL FORMS
UNIT IV

JOB SHEET #6--REMOVE FORMS AND PREPARE FOR STORAGE

(NOTE: The part of this job sheet about preparation for storage is only applicable if prefabricated forms are used.)

I. Tools and materials

  A. Tools

    1. Wrecking bar (crow bar)
    2. Claw hammer, 16 oz or larger
    3. Wire cutter
    4. Large paint brush, mop, or roller
    5. Sprayer
    6. Tie rod tool

  B. Materials--Preservative or form oil

II. Procedure

  A. Remove forms

  (NOTE: Remove in reverse order from installation.)

    1. Remove braces

    (NOTE: Care should be taken not to damage the lumber any more than necessary so that it may be reused.)

    2. Loosen or cut the ties
    3. Pull all nails holding the form sections together
    4. Strip the forms from the green concrete

    (NOTE: Be very careful as you strip the forms as the concrete is still green and can be chipped or damaged very easily at this stage.)

    (CAUTION: Do not pry against green concrete.)

    5. Remove all nails from forms that are not to be reused; remove only those nails from prefabricated forms that were used to join panels

JOB SHEET #6

B. Prepare forms for storage

1. Clean the dried concrete from the face of the forms
2. Coat all form surfaces with form oil
3. Stack the form panels face-to-face on a level surface
4. Cover forms with a sheet of plastic if they are to remain outside
5. Clean and store all form accessories

(NOTE: Forms should be stacked face-to-face and positioned so that any water will drain from them.)

WALL FORMS
UNIT IV

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. Terms and definitions are continued on the following page.

______a. Piece of wood or other material that directs, resists, or supports weight or pressure

______b. Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

______c. Double-headed nail used in forming and designed for easy removal

______d. Enlarged area at the base of a wall or other object to distribute the weight of the superstructure

______e. Wire or metal cross tie used to hold the pressure of wet concrete and maintain the proper wall thickness

______f. That portion of a wall upon which the structure rests

______g. Level of the finished concrete in a form

______h. Beveled piece of wood or metal placed in a form where future pours occur

______i. Groove left in the concrete by removal of the key

______j. Continuous mass of concrete cast as a single unit

______k. Piece of material nailed across a splice to strengthen and hold the two pieces together

______l. Wide boards, plywood, or metal that make up the face of the form

______m. Piece of wood that is used to hold the sides of the form apart and is removed as the concrete is poured; may also be an integral part of the form tie

1. Footing
2. Grade point
3. Key way
4. Scab
5. Spreader
6. Brace
7. Form tie
8. Monolithic pour
9. Duplex nail
10. Cleat
11. Sheathing
12. Foundation
13. Key

______n. Block of wood or other material used as a spacer at offsets in form

______o. Small boards or steel bars sharpened on one end and driven into the ground to support the form

______p. Short piece of steel bar used to tie adjoining pours together

______q. Board placed in a form to cut off the concrete pour

______r. Paraffin oil or other manufactured product used on forms to prevent adhesion of the concrete to the form

______s. Single section of patented or job-built forms

______t. Upright architectural member treated as a column; usually projects a third or less of its width from the wall

______u. Tool or device attached to a string; used to set and/or check the plumb or perpendicular of a surface

______v. Combination of members arranged in units to form a rigid framework for supporting loads over long spans

______w. Part of a structural assembly for slipforming which keeps the forms from spreading and transfers form load to the jack

______x. Horizontal brace used in form construction

______y. Bottom safety rails on a scaffold

______z. Cross members of a truss

______aa. Steel bars used to reinforce concrete which must sustain bending, stretching, or twisting forces

14. Spacer block
15. Form oil
16. Plumb bob
17. Yoke
18. Dowel
19. Toe boards
20. Panel
21. Stakes
22. Webs
23. Rebars (reinforcing bars)
24. Waler
25. Truss
26. Pilaster
27. Bulkhead

2. Identify the parts of a form by writing the correct names in the blanks provided.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

g. ____________________

h. ____________________

i. ____________________

j. ____________________

k. ____________________

l. ____________________

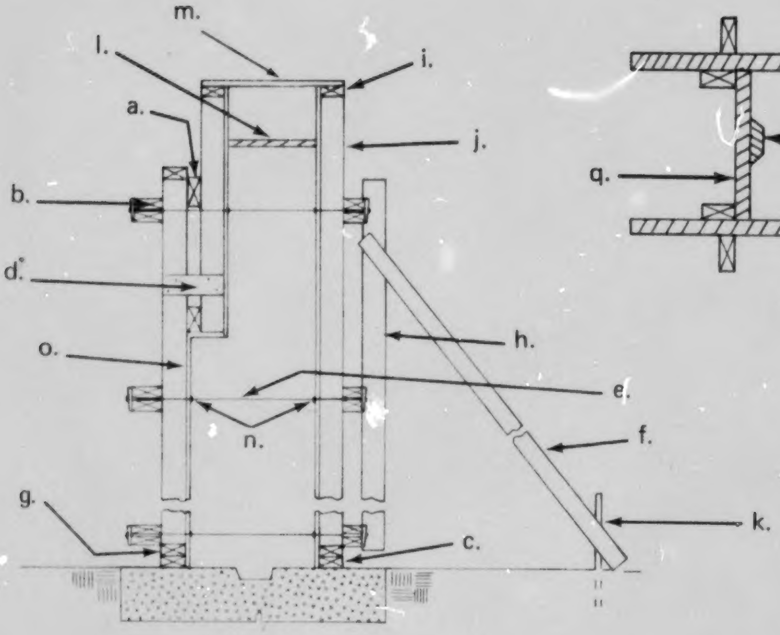
m. ____________________

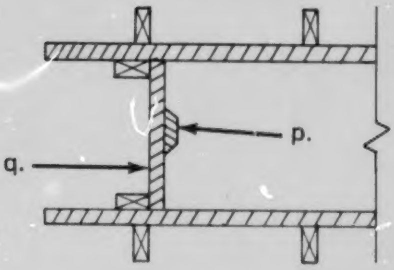
n. ____________________

o. ____________________

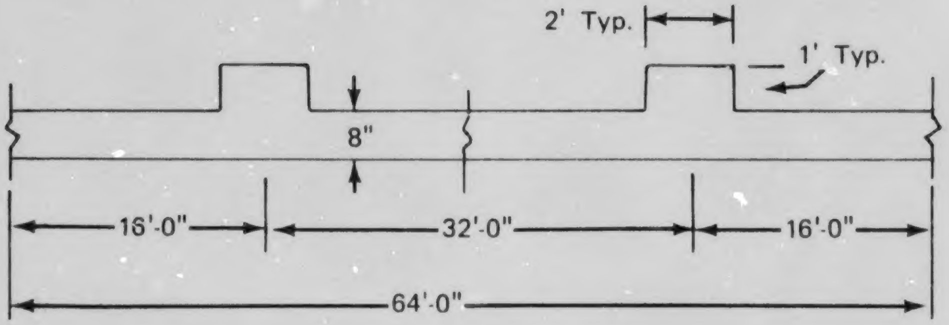
p. ____________________

q. ____________________


m.
l.
i.
a.
j.
b.
d.
h.
o.
e.
f.
n.
g.
k.
c.



3. Estimate the material needed to build forms for the section of wall shown below.



Facts given:

Wall 12' high
Tie and waler spacing 2'cc
Brace 44" cc one side only with 3' stakes
No sole plate required

a. Studs (number and length)

b. Sheathing (sq. ft.)

c. Plates (lineal ft.)

d. Walers (lineal ft.)

e. Waler spacer blocks and supports (lineal ft.)

f. Braces (number and length)

g. Stakes (number)

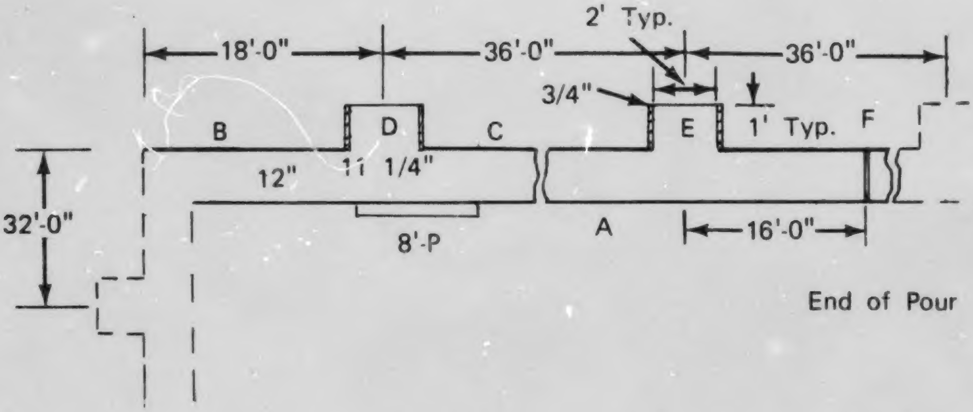
h. Form ties

    1) Wall

    2) Pilaster

i. Form tie clamps

4. Estimate the width and number of panels needed to form the wall section shown below.


2' Typ.
18'-0"
36'-0"
36'-0"
3/4"
B
D
C
E
1' Typ.
F
12"
11 1/4"
32'-0"
8'-P
A
16'-0"
End of Pour

Assume:
a. Horizontal tie spacing is 2' cc
b. Main panel is 8'-0"
c. Starting location of a main panel is shown

	Width	Number
a. Wall A		
Main panels	______	______
Filler panels	______	______
b. Wall B		
Main panels	______	______
Filler panels	______	______
c. Wall C		
Main panels	______	______
Filler panels	______	______
d. Wall F		
Main panels	______	______
e. Pilasters D and E		
Face panels	______	______
Side panels	______	______

5. Name materials used to construct forms.

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

6. Name five types of forms constructed.

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

   e. ____________________

7. List advantages of gang and panel forms over built-in-place or erected-in-place forms.

   a. ____________________

   b. ____________________

   c. ____________________

   d. ____________________

8. List reasons built-in-place or erected-in-place forms might be used.

   a. ____________________

   b. ____________________

9. Demonstrate the ability to:

   a. Construct straight wall with patented forms.

   b. Construct gang forms for a battered wall.

   c. Construct circular wall forms built in place.

   d. Construct panel forms.

   e. Construct slip forms.

   f. Remove forms and prepare for storage.

   (NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

WALL FORMS
UNIT IV

ANSWERS TO TEST

1. a. 6
   b. 10
   c. 9
   d. 1
   e. 7
   f. 12
   g. 2
   h. 13
   i. 3
   j. 8
   k. 4
   l. 11
   m. 5
   n. 14
   o. 21
   p. 18
   q. 27
   r. 15
   s. 20
   t. 26
   u. 16
   v. 25
   w. 17
   x. 24
   y. 19
   z. 22
   aa. 23

2. a. Spacer block
   b. Waler
   c. Sole plate
   d. Scab
   e. Form tie
   f. Brace
   g. Bottom plate
   h. Strongback
   i. Top plate
   j. Stud
   k. Stake

l. Spreader

m. Cleat

n. Spreader washers

o. Sheathing

p. Key

q. Bulkhead

3. a. 86 - 2 x 4 - 12'

b. 1584 sq. ft.

c. 132 lineal feet of 2 x 4

d. 768 lineal feet of 2 x 4

e. 198 lineal feet

f. 16 - 2 x 4 - 14'

g. 17 - 2 x 4 - 14'

h. 1) 372 - 8"

2) 12--20"

i. 768

4.	Width	No.
a.	8'	8
	7'-8 1/2"	1
b.	8'	1
	8'-11 1/4"	1
c.	8'	4
	1'-10 1/2"	1
d.	8'	2
e.	2'-8 1/2"	2
	1'-0"	4

5. a. Wood

b. Steel

c. Fiberglass

d. Combination wood and metal

6. Any five of the following:
    a. Panel
        1) Patented
        2) Job-built
    b. Built-in-place wood
    c. Erected-in-place patented
    d. Gang
        1) Job-built wood
        2) Patented panel
    e. Plate girder
7. a. Faster erection
    b. Faster stripping
    c. More reuses of form material
    d. Cleaner site
8. a. Accessibility of site
    b. Availability of crane or other mechanical lifting device
9. Performance skills evaluated to the satisfaction of the instructor

ON GRADE CURB FORMS
UNIT V

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify types of curbs and median barriers and name methods of constructing their forms. The student should also be able to construct forms for a curb and gutter. This knowledge will be evidenced by completion of the job sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with on grade curb forms to the correct definitions.
2. Identify types of curbs or curbs and gutters.
3. Name methods of forming curbs and gutters or median barriers.
4. Identify types of median barrier forms.
5. Demonstrate the ability to construct a curb and gutter form.

ON GRADE CURB FORMS
UNIT V

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information and job sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in job sheet.

  G. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Curbs and Curb and Gutter Forms

    2. TM 2--Radius Curb and Gutter Forms

    3. TM 3--Radius and Serpentine Forms

    4. TM 4--Manufactured Curb and Gutter Form

    5. TM 5--Manufactured Median Barrier Form

    6. TM 6--Job-Built Curb and Gutter Forms

    7. TM 7--Job-Built Straight Curb with Trench

    8. TM 8--Job-Built Median Barrier Form

    9. TM 9--Types of Median Barrier Forms

  D. Job Sheet #1--Construct a Curb and Gutter Form

  E. Test

  F. Answers to test

III. Unit reference--Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

ON GRADE CURB FORMS
UNIT V

INFORMATION SHEET

I. Terms and definitions

A. Brace or kicker--Piece of wood or other material that directs, resists, or supports weight or pressure

B. Cleat--Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

C. Form snap tie--Wire or metal crosstie used to hold the pressure of wet concrete and maintain the proper wall thickness

D. Monolithic pour--Continuous mass of concrete cast as a single unit

E. Spreader--Block of wood that is used to hold the sides of a form apart and is removed as the concrete is poured; may also be an integral part of the form tie

F. Mule--Template used to shape the profile of a curb and gutter

G. Stakes--Small boards or steel bars pointed on one end and driven into the ground to support a form

H. Division plate--Thin steel plate placed between the forms to provide full depth joints in a curb and gutter

I. Skeleton division plate--Thin steel plate placed between the forms to provide partial depth scoring in curbs and gutters

J. Median barrier--Barrier placed between two lanes of highway

K. Subgrade--Soil prepared and compacted to support a structure or pavement system

L. Battered--Receeding upward slope of the face of the curb

M. Serpentine curb--Type of curb with several lengthwise curves; resembles serpent

N. Formed stud--Part of a job-built median barrier form used to help support the side of form

O. Holddown rod--Rod designed to hold down forms and to keep them from floating up when pouring

P. Hammer clamp--Type of clamp designed for use on curbs; fastened by hitting a sharp blow with a hammer

INFORMATION SHEET

II. Types of curbs or curb and gutters (Transparencies 1, 2, and 3)

- A. Straight face, vertical
- B. Straight face, battered
- C. Single radius, vertical
- D. Single radius, battered
- E. Double radius, vertical
- F. Double radius, battered
- G. Roll type
- H. Highway gutter
- I. Precast
- J. Straight curb
- K. Partially battered curb
- L. Fully battered curb
- M. Radius curb and gutter
- N. Serpentine curb

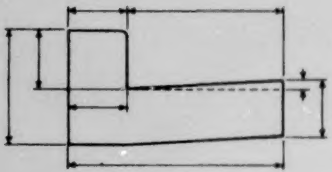
III. Methods of forming curbs and gutters or median barriers (Transparencies 4, 5, 6, 7, and 8)

- A. Manufactured forms
- B. Job-built forms

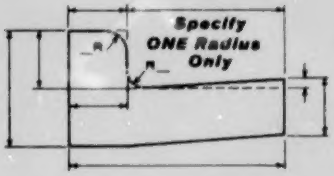
IV. Types of median barrier forms (Transparency 9)

- A. Set on slab
- B. Set on subgrade
- C. One side barrier
- D. Road surfaces at different elevations

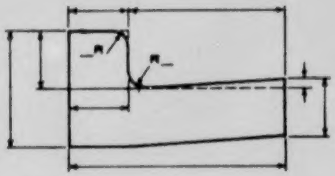
Curbs and Curb and Gutter Forms



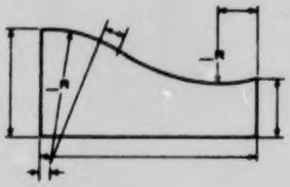
STRAIGHT FACE
Vertical


Specify ONE Radius Only
R
R

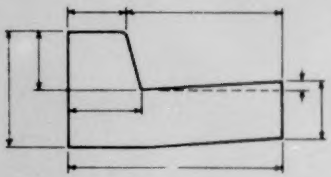
SINGLE RADIUS
Vertical



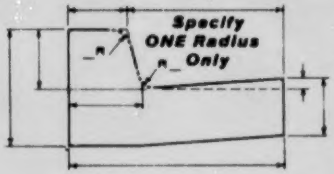
DOUBLE RADIUS
Vertical



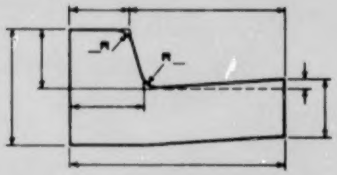
ROLL TYPE



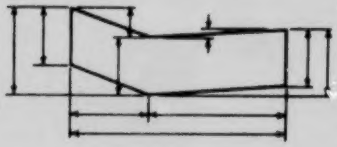
STRAIGHT FACE
Battered


Specify ONE Radius Only
R
R

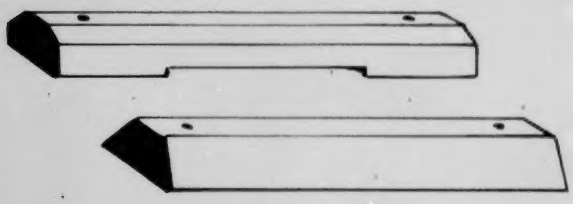
SINGLE RADIUS
Battered



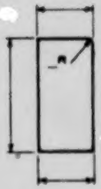
DOUBLE RADIUS
Battered



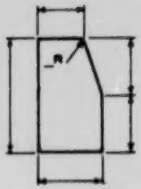
HIGHWAY GUTTER



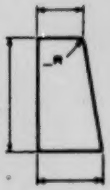
PRECAST



STRAIGHT
CURB

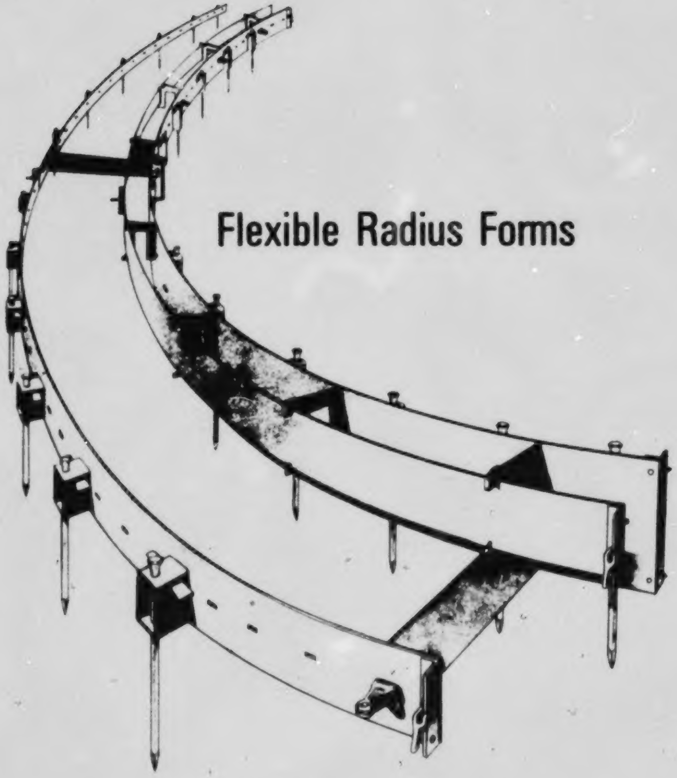


PARTIALLY
BATTERED
CURB



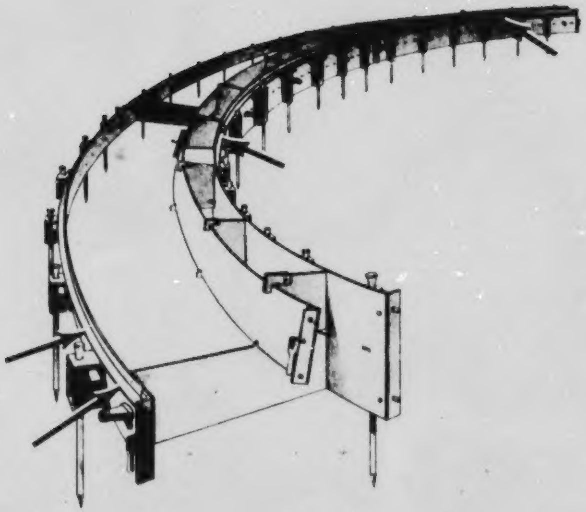
FULLY
BATTERED
CURB

Radius Curb and Gutter Forms

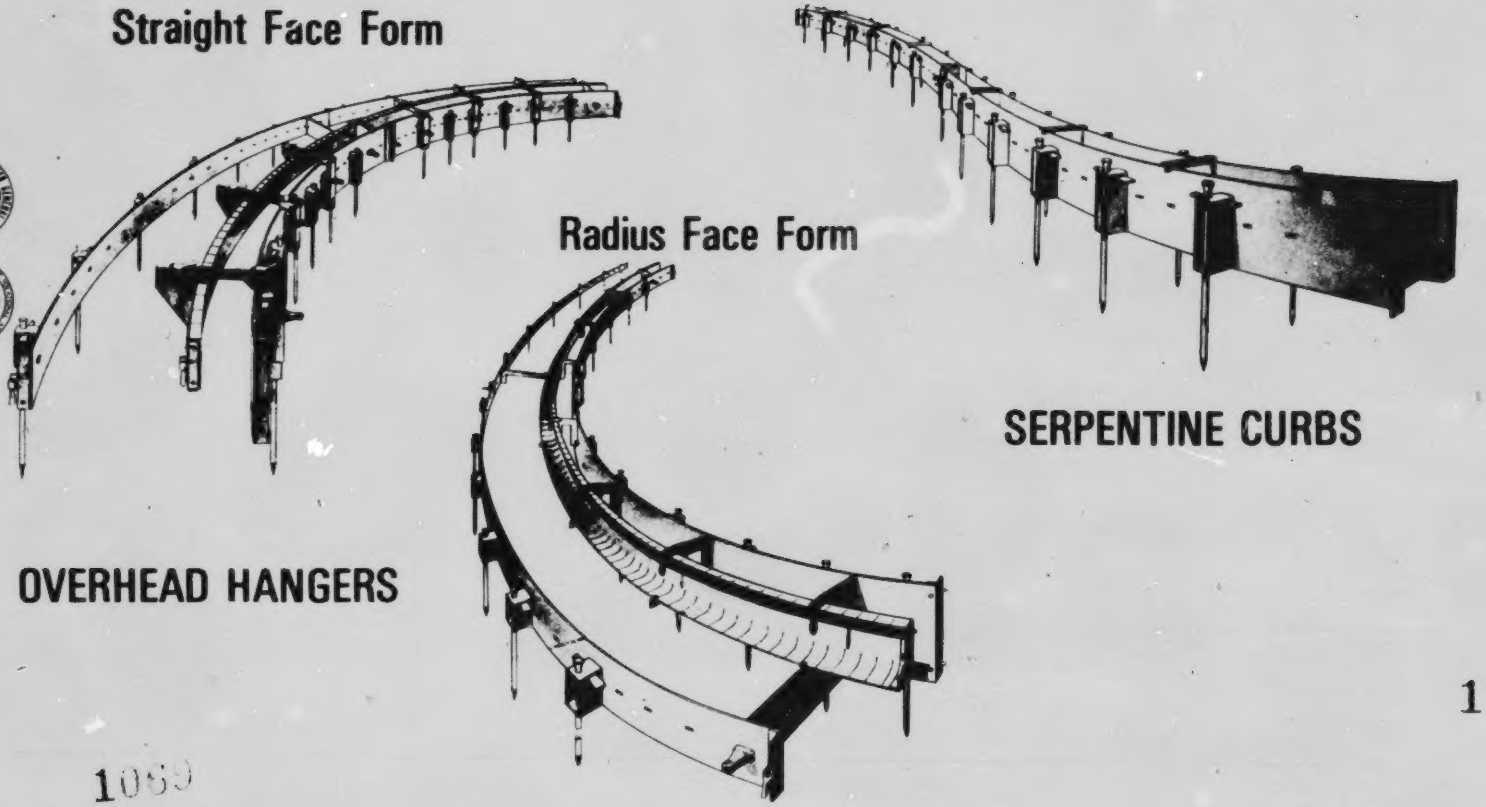


Flexible Radius Forms

Fixed Radius Forms



Radius and Serpentine Forms



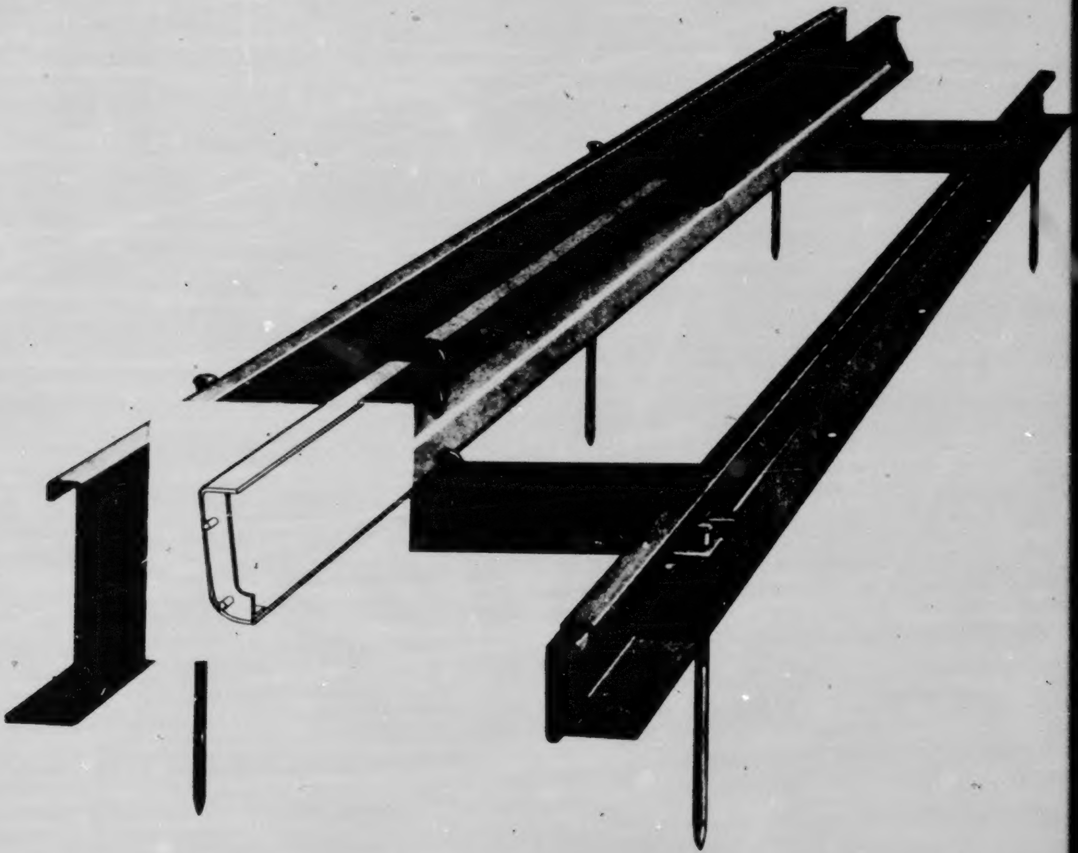
Straight Face Form

OVERHEAD HANGERS

Radius Face Form

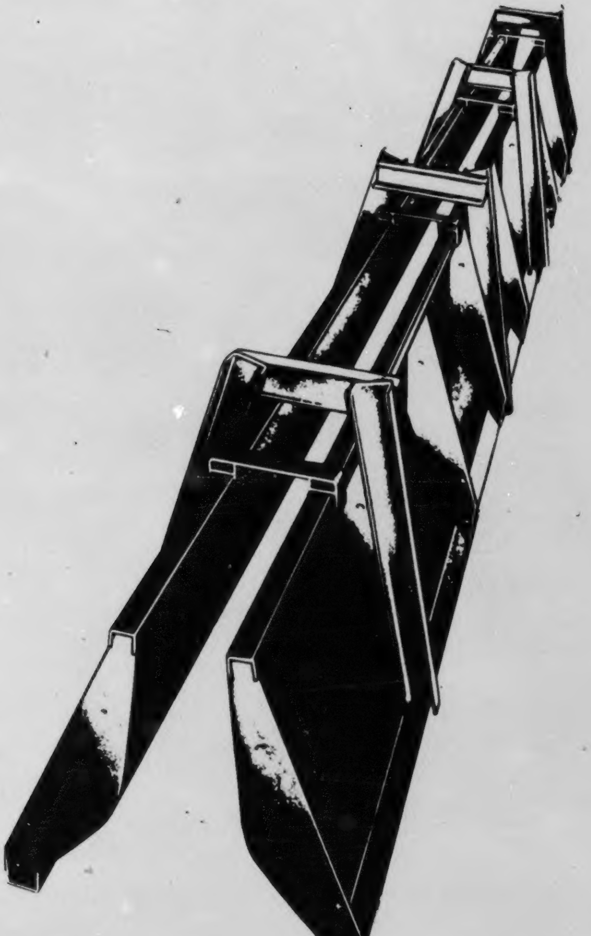
SERPENTINE CURBS

Manufactured Curb and Gutter Form



TM 4

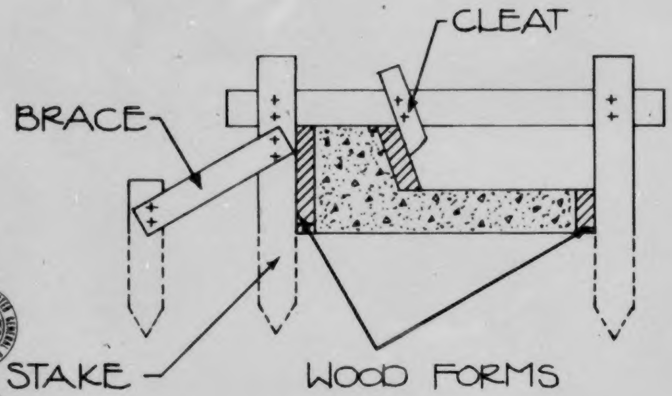
Manufactured Median Barrier Form



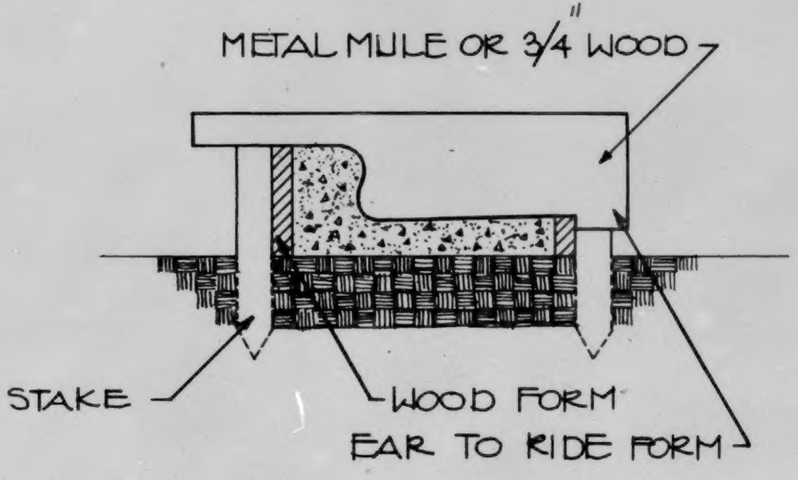
TM 5

1072

Job-Built Curb and Gutter Forms


CLEAT
BRACE
STAKE
WOOD FORMS

CURB AND GUTTER FORMED CURB


METAL MULE OR 3/4" WOOD
STAKE
WOOD FORM
EAR TO RIDE FORM

CURB AND GUTTER MULE FORMED CURB

SCALE 3/4" = 1'-0"

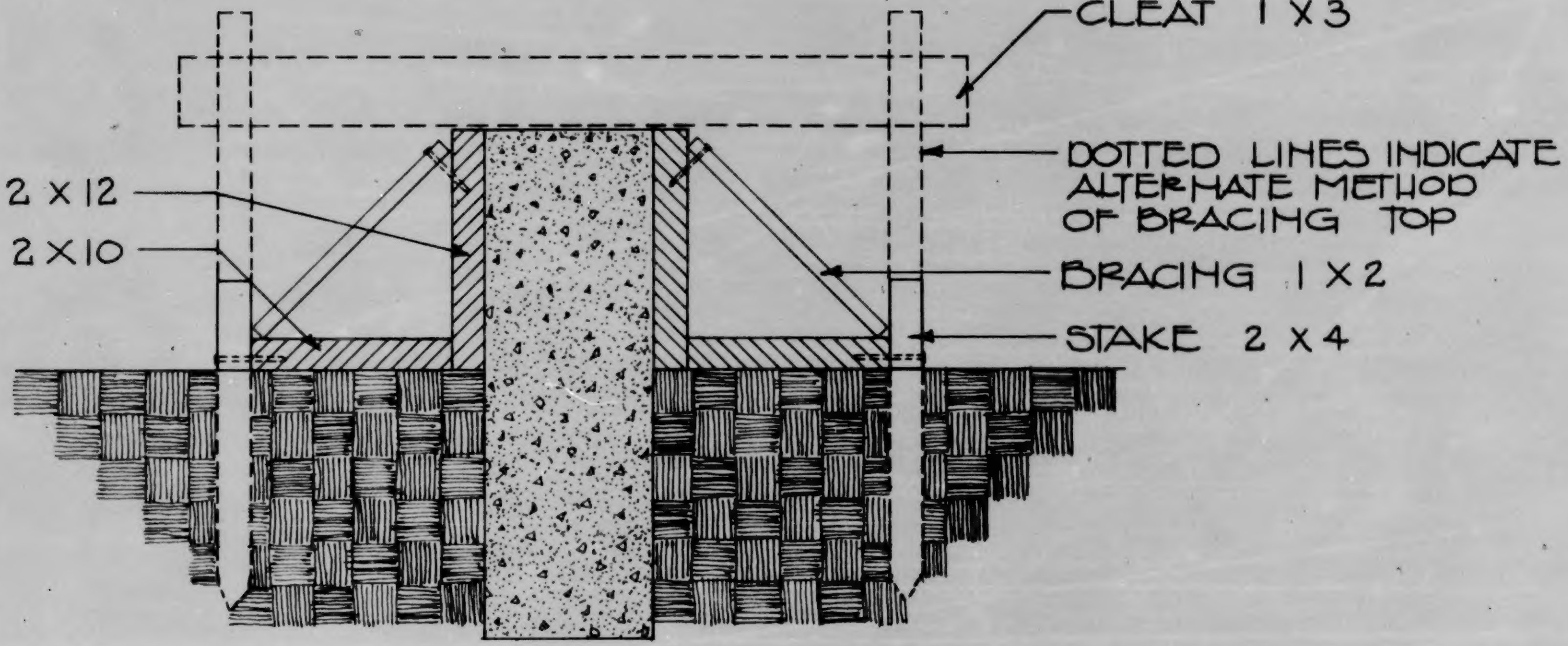
TM 6

1073

1074

CC-275-G

Job-Built Straight Curb With Trench


CLEAT 1 X 3
DOTTED LINES INDICATE ALTERNATE METHOD OF BRACING TOP
2 X 12
2 X 10
BRACING 1 X 2
STAKE 2 X 4

SCALE: 1½" = 1'-0"

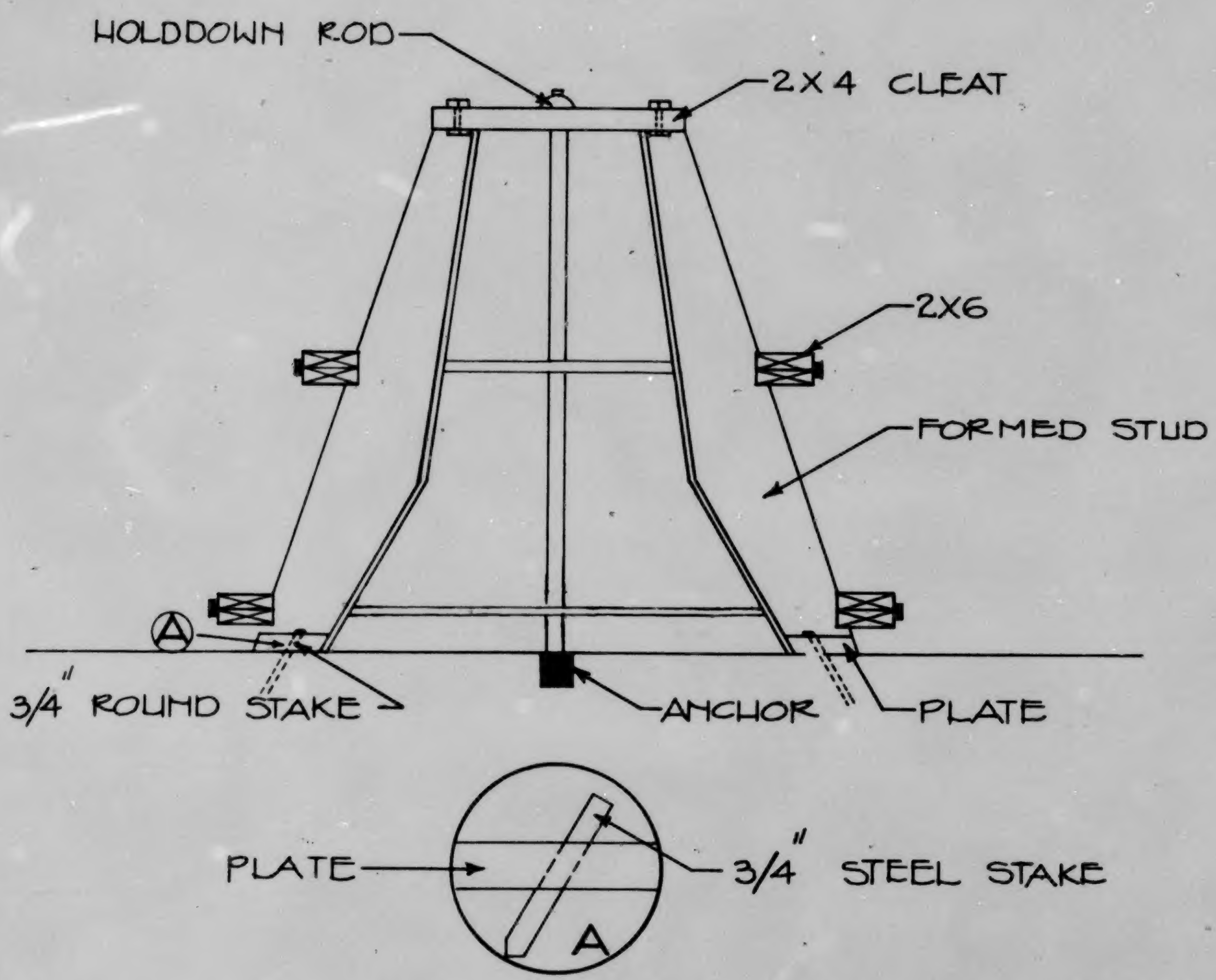
TM 7

1075

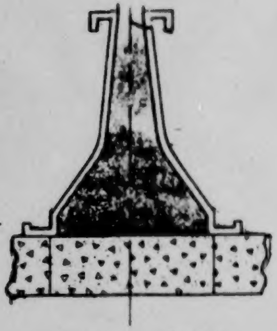
1076

CC-277-G

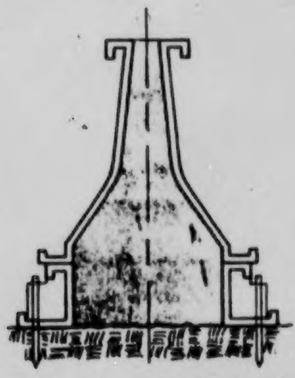
Job-Built Median Barrier Form


HOLDDOWN ROD
2X4 CLEAT
2X6
FORMED STUD
A
3/4" ROUND STAKE
ANCHOR
PLATE
PLATE
3/4" STEEL STAKE
A

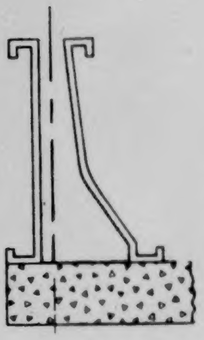
Types of Median Barrier Forms



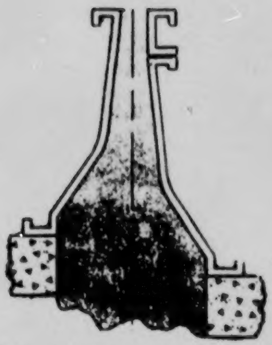
Set on Slab



Set on Subgrade



One Side Barrier



Road Surfaces at Different Elevations

ON GRADE CURB FORMS
UNIT V

JOB SHEET #1--CONSTRUCT A CURB AND GUTTER FORM

I. Tools and materials

A. Tools

1. Sledge hammer
2. Claw hammer, 16 oz or larger
3. Electric handsaw
4. Crosscut handsaw
5. Measuring tape, 100 ft
6. Measuring tape, 12 or 16 ft
7. Level, hand
8. String line
9. Builder's level and rod

B. Materials

1. Stakes
2. 2 x 10's for sheathing
3. Nails
    a. 16d duplex
    b. 8d duplex
4. Hammer clamps

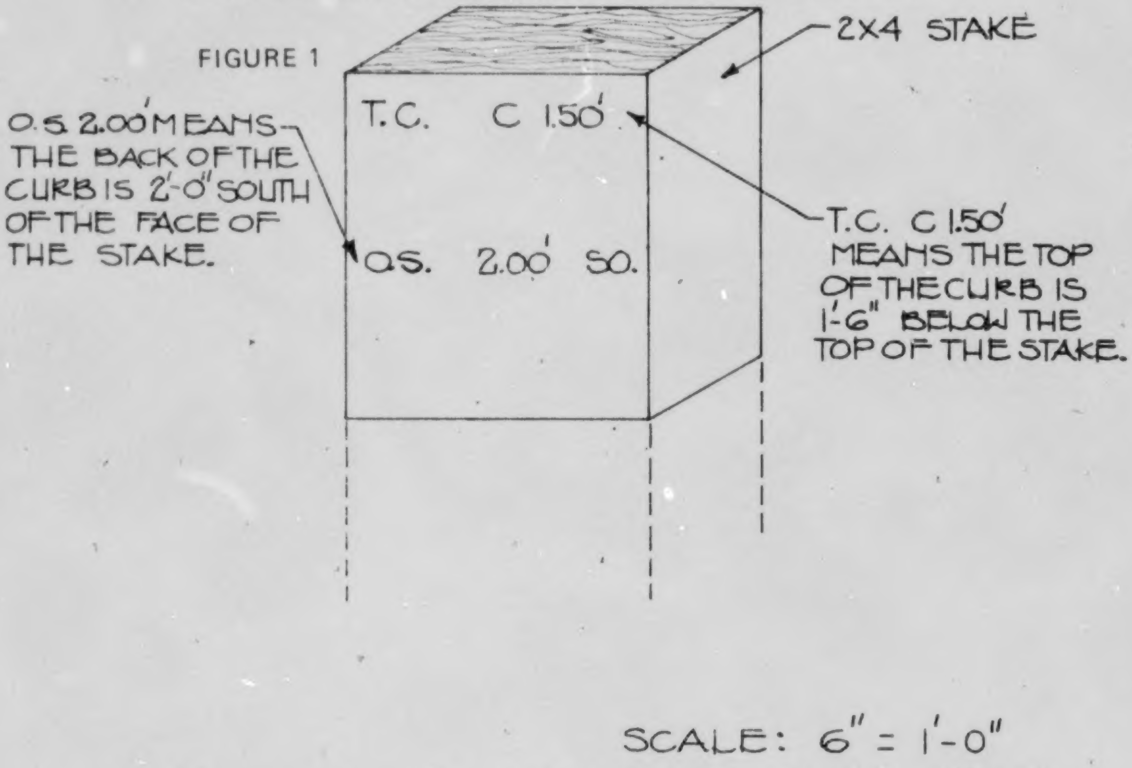
JOB SHEET #1

II. Procedure

A. Establish outside line of curb (Figure 1)

(NOTE: Prior to excavation, offset line and grade stakes have been placed on each side of the road. Check these stakes for offset and elevation.)

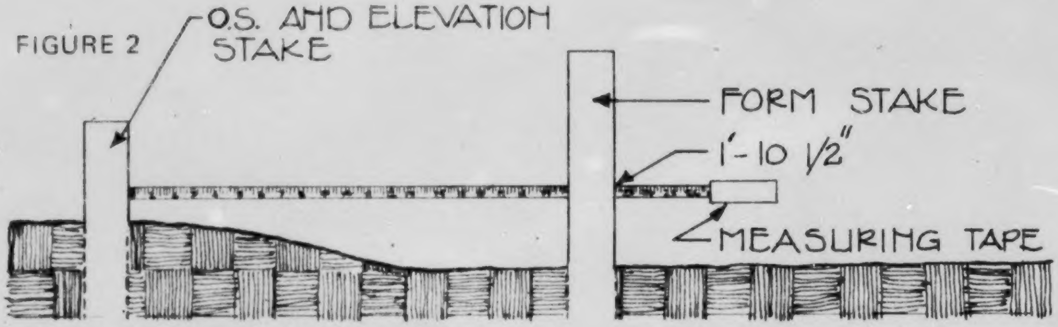
FIGURE 1


2X4 STAKE
T.C. C 1.50'
O.S. 2.00' SO.
O.S. 2.00' MEANS THE BACK OF THE CURB IS 2'-0" SOUTH OF THE FACE OF THE STAKE.
T.C. C 1.50' MEANS THE TOP OF THE CURB IS 1'-6" BELOW THE TOP OF THE STAKE.
SCALE: 6" = 1'-0"

B. Measure over from offset stake to determine form stake location (Figure 2)

(NOTE: Deduct thickness of the form material from the offset dimension.)

FIGURE 2

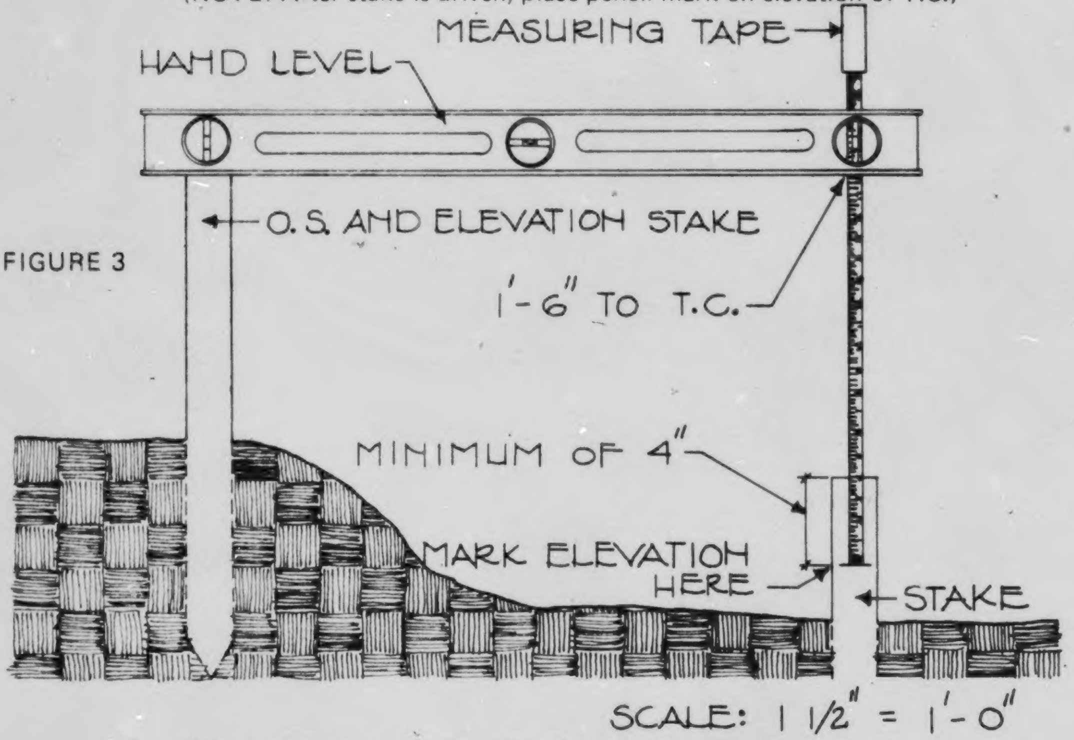

O.S. AND ELEVATION STAKE
FORM STAKE
1'-10 1/2"
MEASURING TAPE

JOB SHEET #1

C. Check stakes for elevation as they are driven (Figure 3)

(NOTE: After stake is driven, place pencil mark on elevation of T.C.)

FIGURE 3


MEASURING TAPE
HAND LEVEL
O. S. AND ELEVATION STAKE
1'-6" TO T.C.
MINIMUM OF 4"
MARK ELEVATION HERE
STAKE
SCALE: 1 1/2" = 1'-0"

D. Drive stakes opposite each offset stake as shown in Figure 3

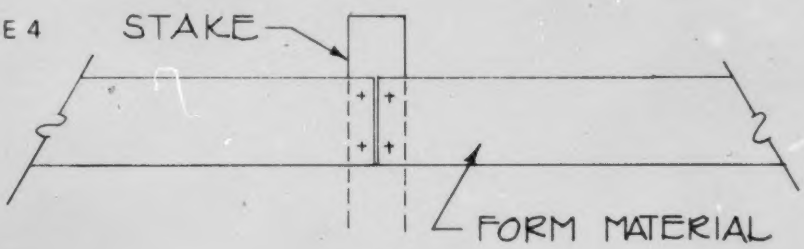
(NOTE: Offset stakes are usually set every twenty feet.)

E. Lay form material end to end along line of curb

F. Attach line to stakes at elevation and drive intermediate stakes; mark elevation of T.C. on stakes

(NOTE: Intermediate stake spacing can vary, but a stake must be driven at the joint of each length of form material. See Figure 4.)

FIGURE 4

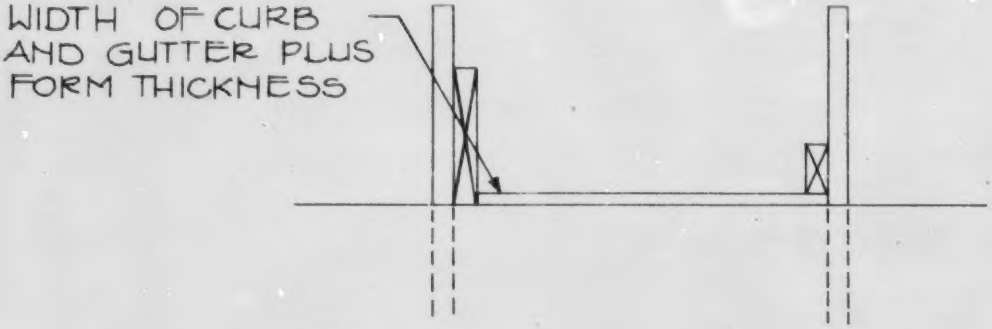

STAKE
FORM MATERIAL

JOB SHEET #1

G. Nail form material to stakes

H. Set opposite side stakes using spreader for location (Figure 5)

FIGURE 5

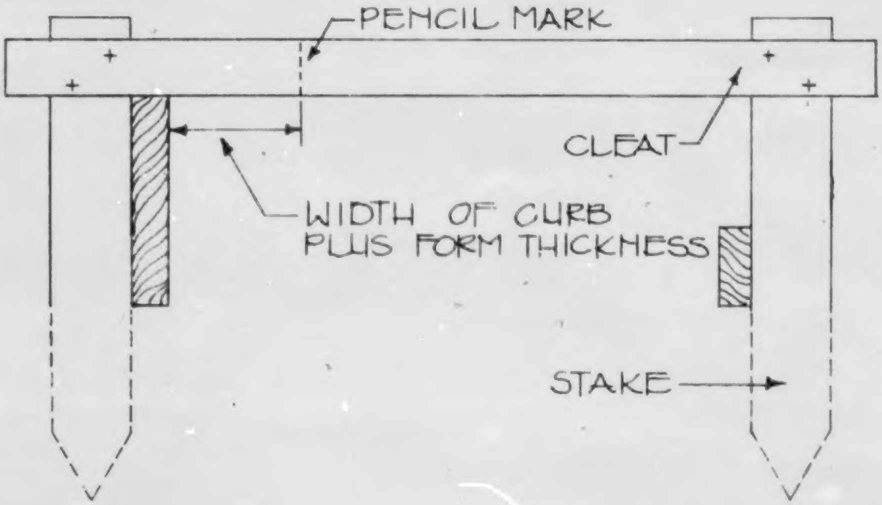

WIDTH OF CURB
AND GUTTER PLUS
FORM THICKNESS

I. Nail form material to stakes

J. Nail a cleat across the stakes to support inside curb form; mark face of curb plus form on cleat (Figure 6)

(NOTE: The inside form may be suspended on stakes driven into the ground if this is permissible. This is a much faster installation.)

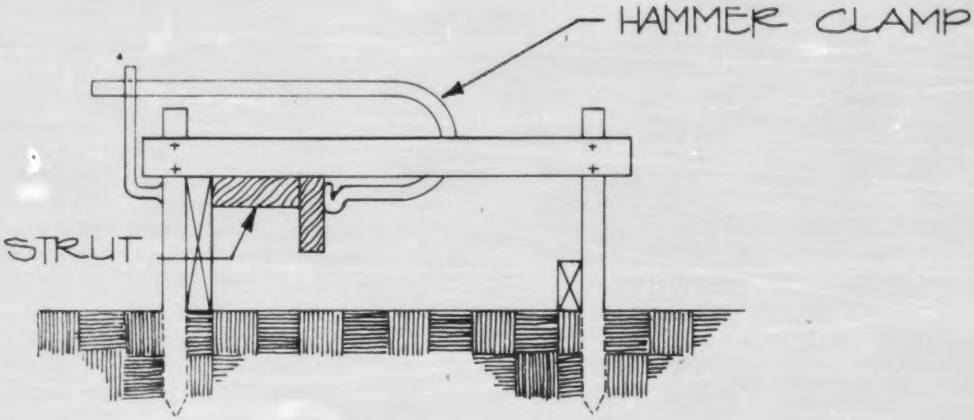
FIGURE 6


PENCIL MARK
CLEAT
WIDTH OF CURB
PLUS FORM THICKNESS
STAKE

JOB SHEET #1

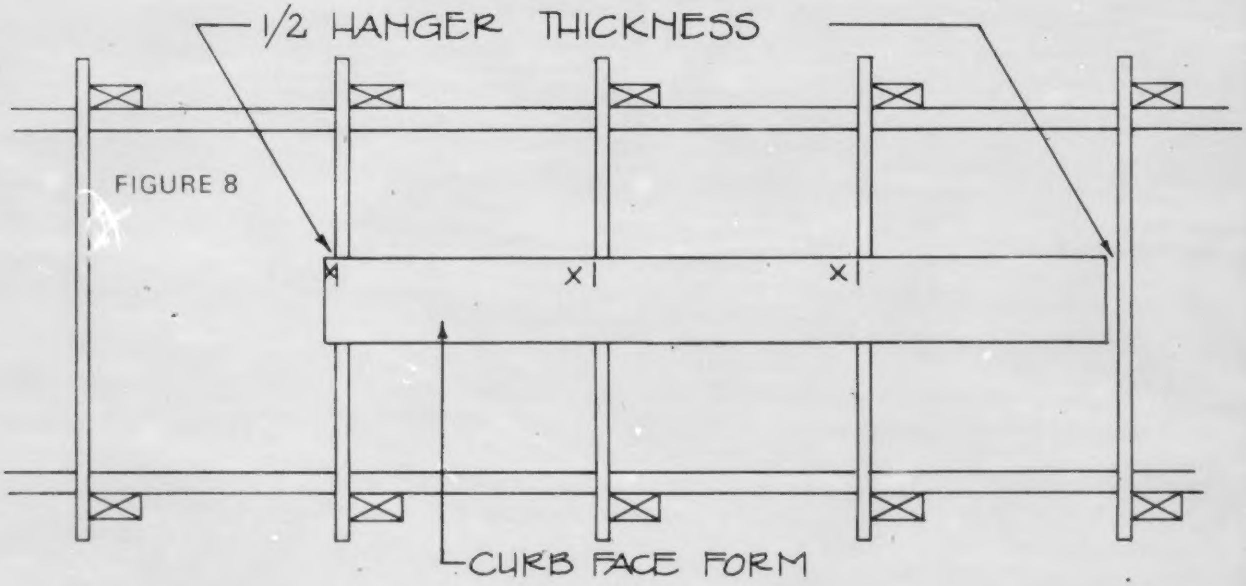
(NOTE: The inside form may be clamped into place using hammer clamps and struts. See Figure 7.)

FIGURE 7


HAMMER CLAMP
STRUT

K. Lay curb face forms on cleats and lay out hanger location (Figure 8)

FIGURE 8

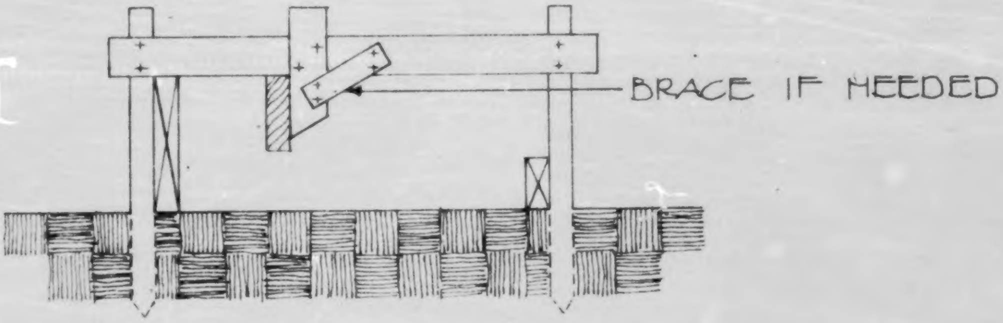

1/2 HANGER THICKNESS
CURB FACE FORM

L. Nail hangers to face form

M. Nail hangers to cleat (Figure 9)

(NOTE: All cleats and hangers should be nailed with duplex nails for easy removal.)

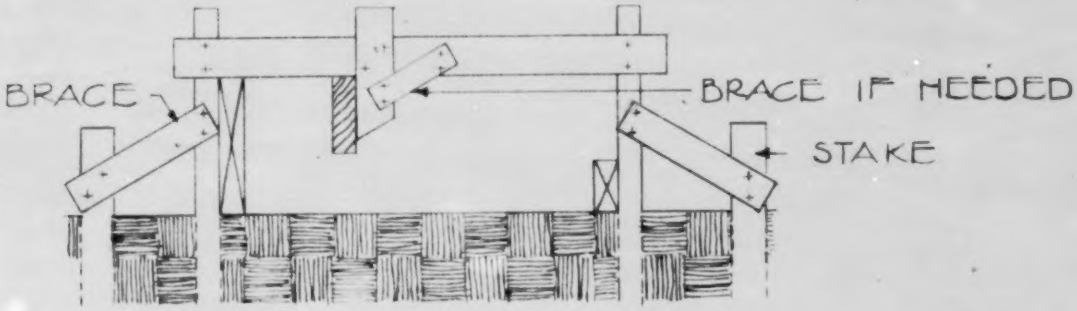
FIGURE 9


BRACE IF NEEDED

N. Repeat steps K, L, and M to complete forms

O. Install braces if forms need aligning (Figure 10)

FIGURE 10


BRACE
BRACE IF NEEDED
STAKE

ON GRADE CURB FORMS
UNIT V

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Piece of wood or other material that directs, resists, or supports weight or pressure

_____b. Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

_____c. Receding upward slope of the face of the curb

_____d. Wire or metal crosstie used to hold the pressure of wet concrete and maintain the proper wall thickness

_____e. Type of curb with several lengthwise curves; resembles serpent

_____f. Continuous mass of concrete cast as a single unit

_____g. Block of wood that is used to hold the sides of a form apart and is removed as the concrete is poured; may also be an integral part of the form tie

_____h. Part of a job-built median barrier form used to help support the side of form

_____i. Template used to shape the profile of a curb and gutter

_____j. Rod designed to hold down forms and to keep them from floating up when pouring

_____k. Small boards or steel bars pointed on one end and driven into the ground to support a form

_____l. Thin steel plate placed between the forms to provide full depth joints in a curb and gutter

1. Division plate
2. Stakes
3. Median barrier
4. Brace or kicker
5. Subgrade
6. Skeleton division plate
7. Cleat
8. Monolithic pour
9. Mule
10. Form snap tie
11. Spreader
12. Battered
13. Serpentine curb
14. Formed stud
15. Holddown rod
16. Hammer clamp

______m. Thin steel plate placed between the forms to provide partial depth scoring in curbs and gutters

______n. Type of clamp designed for use on curbs; fastened by hitting a sharp blow with a hammer

______o. Barrier placed between two lanes of highway

______p. Soil prepared and compacted to support a structure or pavement system

2. Identify the types of curbs and curbs and gutters illustrated below and on the next page. Place the numbers of the illustrations in the correct blanks.

______a. Partially battered curb

______b. Highway gutter

______c. Double radius, battered

______d. Single radius, vertical

______e. Straight face, vertical

______f. Single radius, battered

______g. Radius curb and gutter

______h. Roll type

______i. Serpentine curb

______j. Fully battered curb

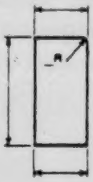
______k. Straight curb

______l. Double radius, vertical

______m. Straight face, battered

______n. Precast

1



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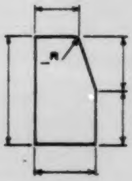

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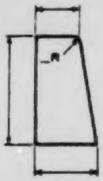

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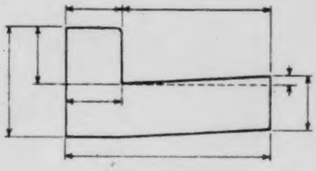

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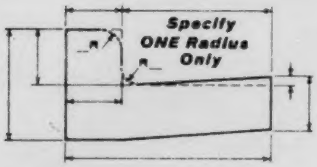

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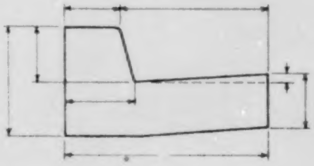

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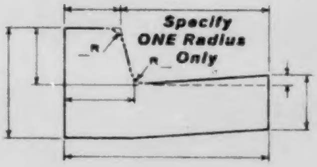

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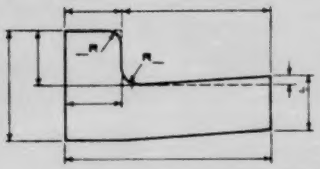

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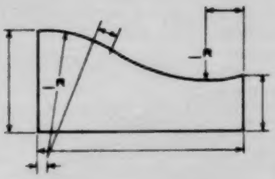

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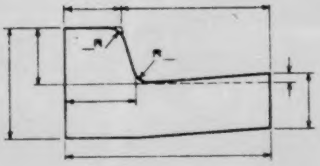

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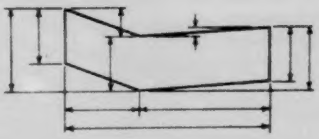

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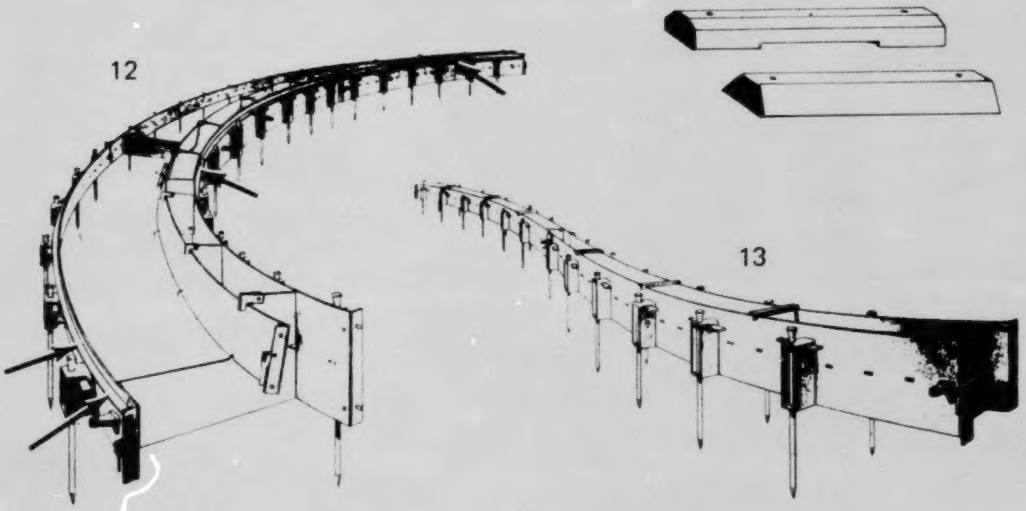


3. Name the methods of forming curbs and gutters or median barriers.

a. ______________________________

b. ______________________________

4. Identify the types of median barrier forms ilustrated below. Place the correct numbers in the blanks provided below.

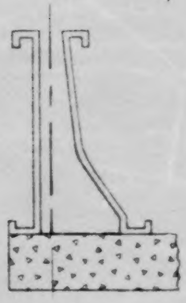
_____ a. Set on slab

_____ b. Set on subgrade

_____ c. One side barrier

_____ d. Road surfaces at different elevations

1



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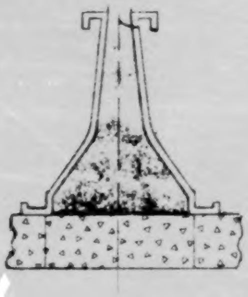

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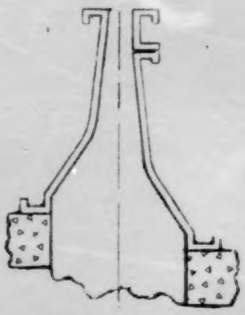

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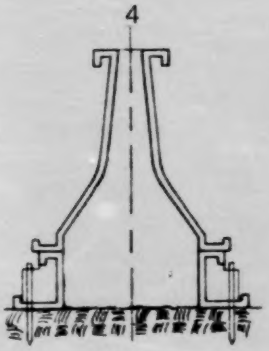


5. Demonstrate the ability to construct a curb and gutter form.

(NOTE: If the above activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

ON GRADE CURB FORMS
UNIT V

ANSWERS TO TEST

1.
   a. 4
   b. 7
   c. 12
   d. 10
   e. 13
   f. 8
   g. 11
   h. 14
   i. 9
   j. 15
   k. 2
   l. 1
   m. 6
   n. 16
   o. 3
   p. 5

2.
   a. 2
   b. 11
   c. 10
   d. 5
   e. 4
   f. 7
   g. 12
   h. 9
   i. 13
   j. 3
   k. 1
   l. 8
   m. 6
   n. 14

3.
   a. Manufactured forms
   b. Job-built forms

4.
   a. 2
   b. 4
   c. 1
   d. 3

5. Performance skill evaluated to the satisfaction of the instructor

VERTICAL PIERS AND COLUMNS
UNIT VI

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify column shapes and name materials used to construct column forms. The student should also be able to name methods of column form construction. The student should be able to construct forms for a round fluted column and a square column and set a round column. This knowledge will be evidenced by completion of job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with vertical piers and columns to the correct definitions.
2. Identify column shapes.
3. Name materials normally used for column forms.
4. Name methods of column form construction.
5. Demonstrate the ability to:
    - a. Construct forms for a round fluted column.
    - b. Construct forms for a square column.
    - c. Set a round column (fiberboard tube).

VERTICAL PIERS AND COLUMNS
UNIT VI

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information and job sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in job sheets.

  G. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Column Shapes

    2. TM 2--Column Form Material

    3. TM 3--Examples of Job-Built Column Forms

    4. TM 4--Job-Built L-Shaped Column Form

    5. TM 5--Manufactured Panel: Square Column Form

    6. TM 6--Manufactured Panels: L-Shaped Column Form

  D. Job sheets

    1. Job Sheet #1--Construct Forms for a Round Fluted Column

    2. Job Sheet #2--Construct Forms for a Square Column

    3. Job Sheet #3--Set a Round Column (Fiberboard Tube)

  E. Test

  F. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

B. Smith, Ronald C. *Principles and Practices of Heavy Construction*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

C. Peurifoy, R. L. *Formwork for Concrete Structures*. New York: McGraw-Hill Book Company, 1964.

D. Hendrix, Laborn J. "Bud," and Patton, Bob. *Construction Craftsman's Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1978.

VERTICAL PIERS AND COLUMNS
UNIT VI

INFORMATION SHEET

I. Terms and definitions

A. Column clamp--Manufactured device surrounding a column form to hold the pressure exerted by wet concrete

B. Yoke--Job-built device surrounding a column form to hold the pressure exerted by wet concrete

C. Sheathing--Wide boards, plywood, or metal that make up the face of a form

D. Capital--Enlarged area at the top of a column

E. Grade point--Level of finished concrete in a form

F. Pier--Support for an arch or a supporting section of wall between two openings

G. Column--Vertical shaft of many shapes designed to support the structure above

H. Staves--Vertical sheathing in a circular column form

I. Form tie--Wire or metal crosstie used to hold the pressure of wet concrete and maintain the proper wall thickness

J. Strongback--Temporary brace attached to the back of forms to help support them when lifting and moving them

K. Diameter--Straight line passing through the center of a circle or sphere and terminating in the circumference

L. Radius--Straight line radiating from the center of a circle or sphere to the circumference; semidiameter of a circle or sphere

M. Template--Gauge used as a pattern for copying or making identical parts

N. Flutes--Strips that form channels or grooves; used to decorate columns, especially in classical architecture

O. Stagger joints--To arrange in uneven lines, one row alternating with the spaces of another row

P. Wedge--Tapered piece of wood or metal

INFORMATION SHEET

Q. Column steel--Reinforcing rod shaped in round coils (like a spring) and tied to the vertical steel

R. Strap wrench--Wrench that is used to tighten and hold band steel until it is secured

II. Column shapes (Transparency 1)

A. L-shaped

B. Square

C. Rectangular

D. Round

E. Tapered

F. Fluted

G. Capitaled

III. Materials normally used for column forms (Transparency 2)

A. Plywood

B. Metal

C. Fiber (paper)

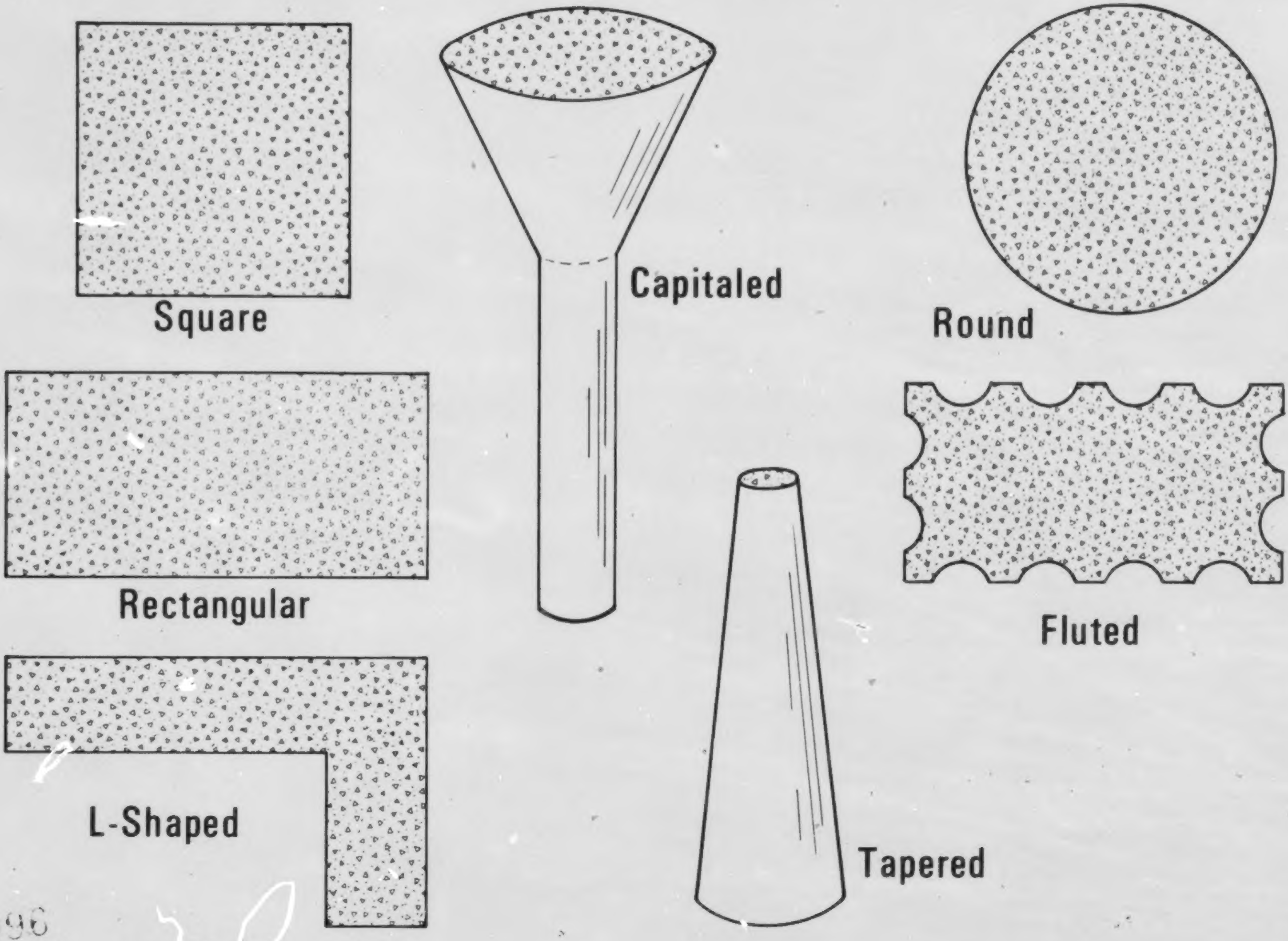
D. Molded fiberglass

IV. Methods of column form construction (Transparencies 3, 4, 5, and 6)

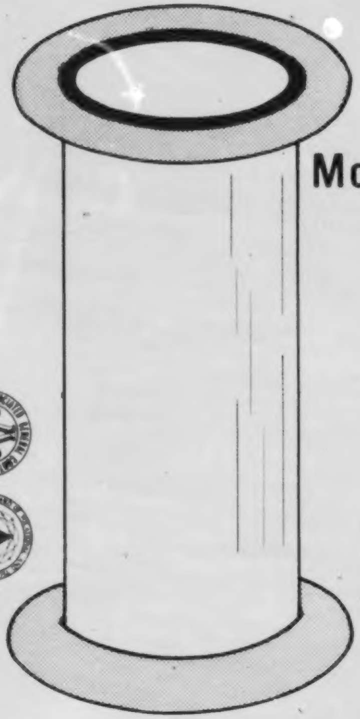
A. Job-built

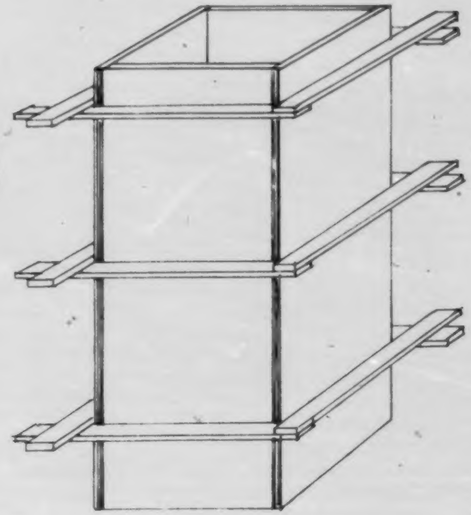
B. Manufactured panels

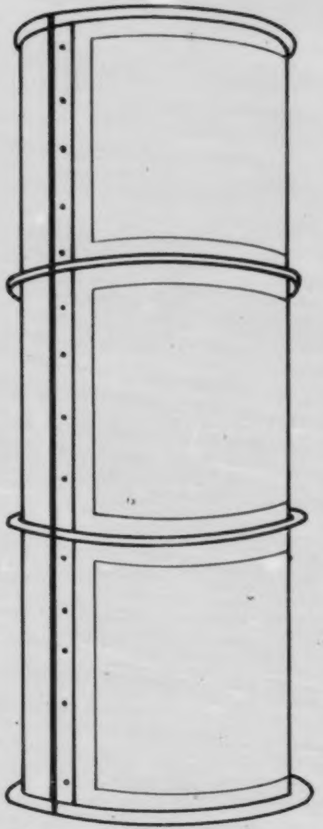
Column Shapes


Square
Capitaled
Round
Rectangular
Fluted
L-Shaped
Tapered

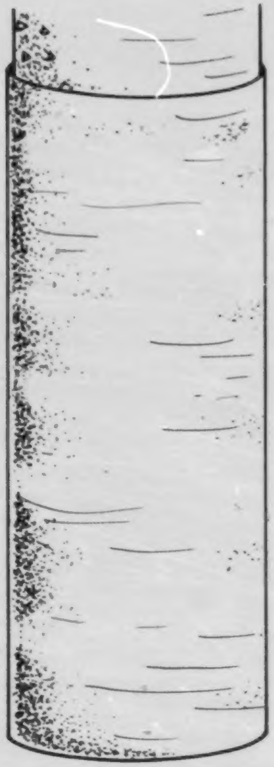
Column Form Material


Molded Fiberglass


Plywood


Steel

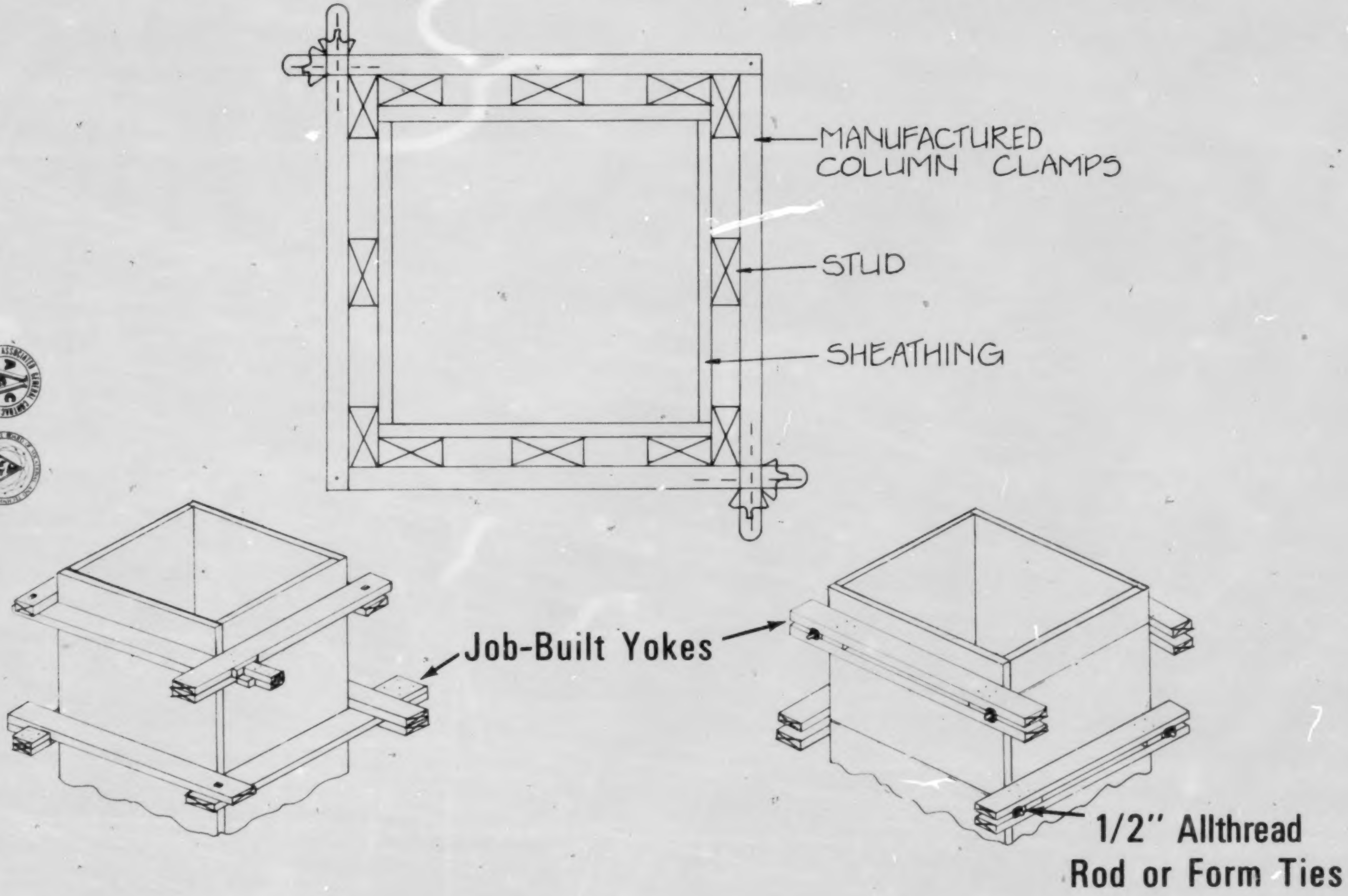
Fiber (Paper)



TM 2

CC - 303-G

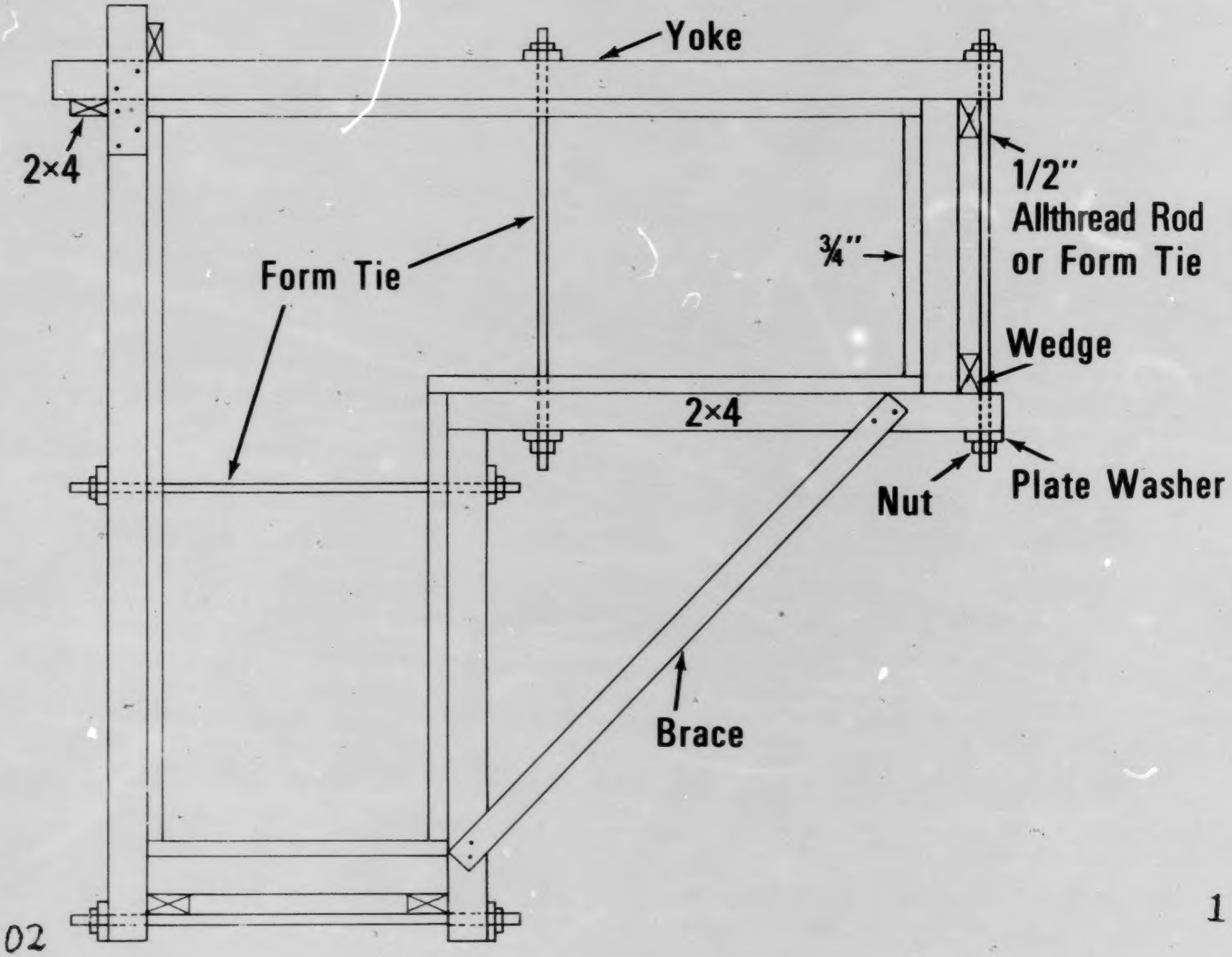
Examples of Job-Built Column Forms


MANUFACTURED COLUMN CLAMPS
STUD
SHEATHING

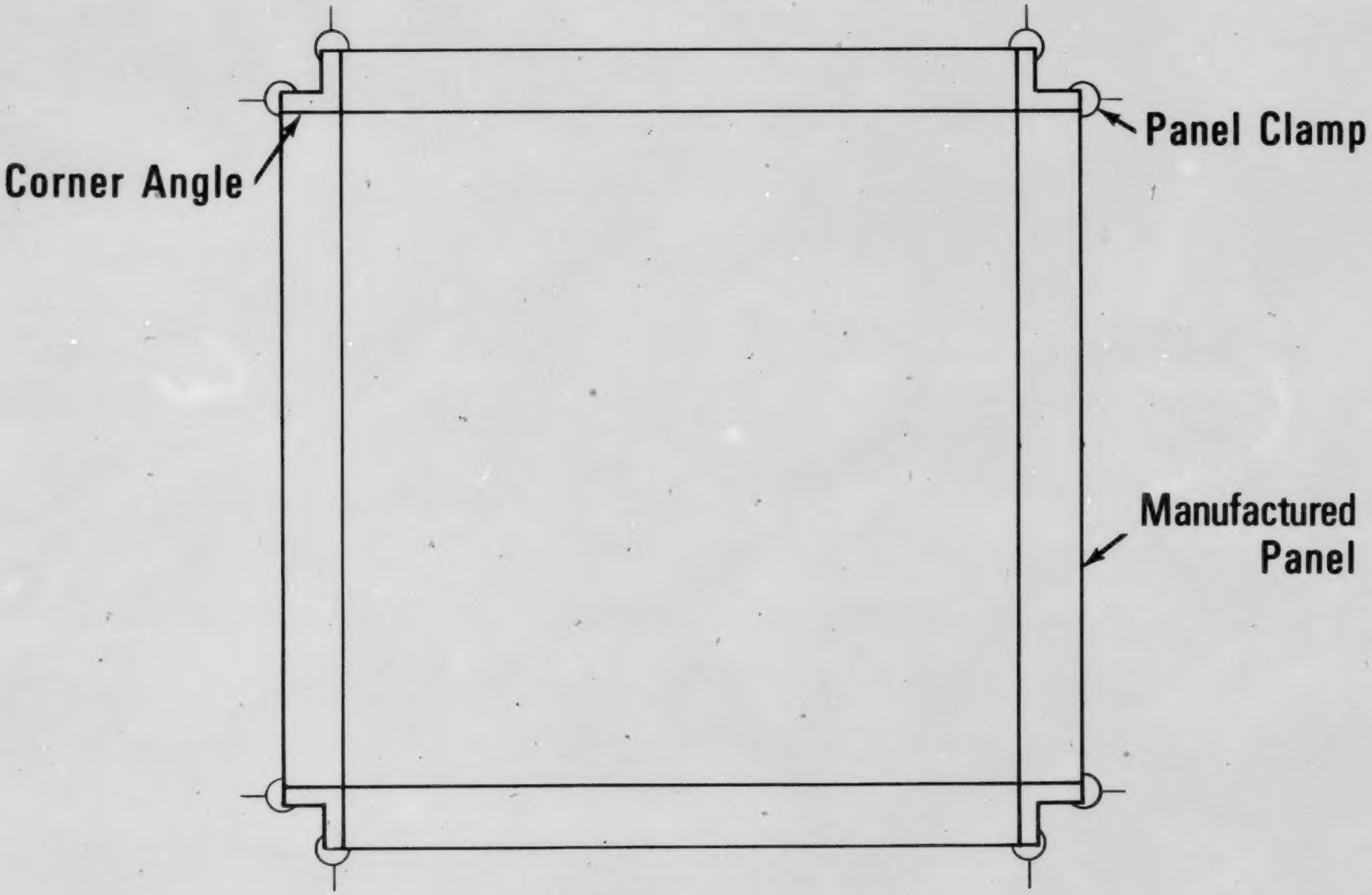
Job-Built Yokes

1/2" Allthread Rod or Form Ties

Job-Built L-Shaped Column Form


Yoke
2×4
1/2" Allthread Rod or Form Tie
Form Tie
¾"
Wedge
2×4
Nut
Plate Washer
Brace

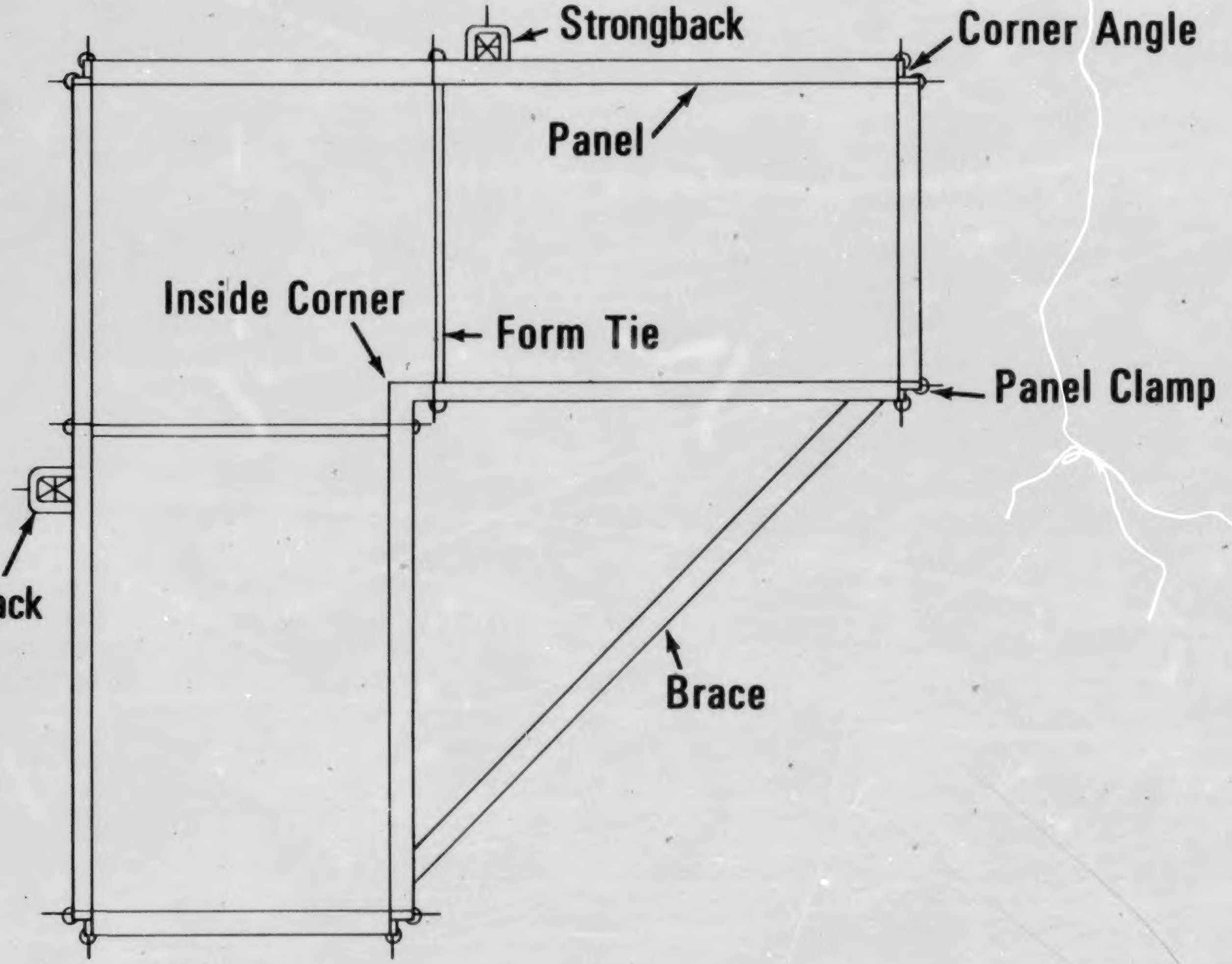
Manufactured Panel Square Column Form


Panel Clamp
Corner Angle
Manufactured Panel

1104

1105

Manufactured Panels
L-Shaped Column Form


Strongback
Corner Angle
Panel
Inside Corner
Form Tie
Panel Clamp
Strongback
Brace

TM-6

1106

1107

CC-311-G

VERTICAL PIERS AND COLUMNS
UNIT VI

JOB SHEET #1--CONSTRUCT FORMS FOR A ROUND FLUTED COLUMN

I. Tools and materials

- A. Tools
  1. Electric handsaw
  2. Crosscut handsaw
  3. Claw hammer, 16 ounce or larger
  4. Tape measure, 12 or 16 foot
  5. Level, hand
  6. Tape measure, 100 foot
  7. Chalk line and reel
  8. Transit
  9. Band saw or saber saw
  10. Drill and bits
  11. String line
  12. Strap wrench
- B. Materials
  1. Staves, 1 x 2
  2. Segments, 3/4" plywood
  3. Studs, 2 x 6's
  4. Setting template, 2 x 4
  5. Steel strapping
  6. Half round wood (flutes)
  7. Form oil (nonstaining)
  8. Angle iron

JOB SHEET #1

9. Screws
10. Bolts
11. Column clamps
12. Nails
    a. Finish, 2d and 6d
    b. Duplex, 6d and 16d
    c. Concrete

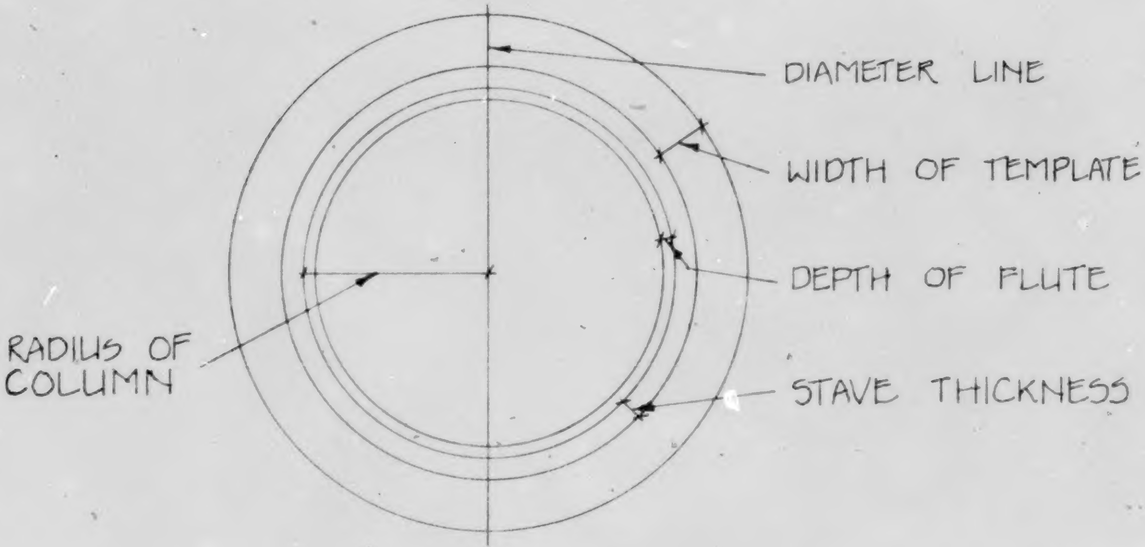
II. Procedure

A. Build forms

1. Lay out full size pattern on the floor or on a piece of plywood (Figure 1)

(NOTE: Diameter line will be the line on which the two halves of the form join. Place stud at each end of the half form.)

FIGURE 1

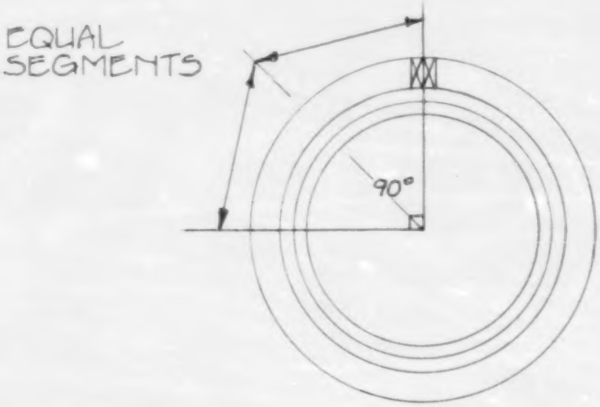

DIAMETER LINE
WIDTH OF TEMPLATE
DEPTH OF FLUTE
STAVE THICKNESS
RADIUS OF COLUMN

JOB SHEET #1

2. Divide quarter section of circle into equal segments (Figure 2)

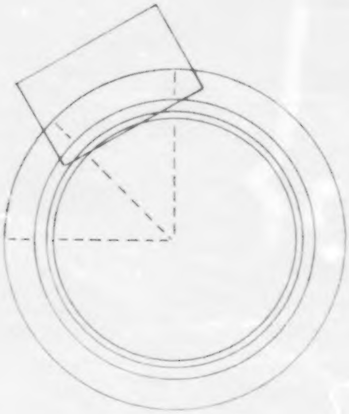
   (NOTE: The length of the segments is determined by the width and grain of the material used. The grain of the material should be as near parallel to the form surface as possible.)

FIGURE 2



3. Lay out template material on drawing and lay out segmental pattern (Figure 3)

FIGURE 3

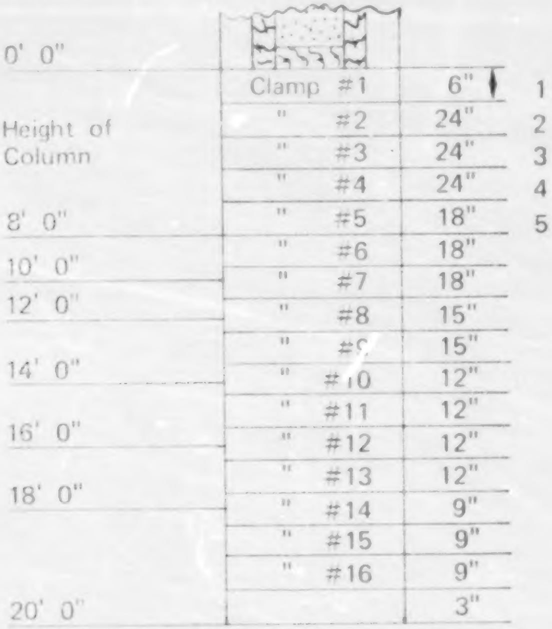


JOB SHEET #1

4. Determine number of segments needed (Figure 4)

(NOTE: Check column clamp spacing schedule for segmental ring spacing. Using the eight-foot column height as an example, there would be five segmental templates needed. Labor can be saved by using steel strapping at intermediate locations.)

FIGURE 4



Height of Column	Clamp	Spacing	
0' 0"			
	Clamp #1	6"	1
Height of Column	" #2	24"	2
	" #3	24"	3
	" #4	24"	4
8' 0"	" #5	18"	5
	" #6	18"	
10' 0"	" #7	18"	
12' 0"	" #8	15"	
	" #9	15"	
14' 0"	" #10	12"	
	" #11	12"	
16' 0"	" #12	12"	
18' 0"	" #13	12"	
	" #14	9"	
	" #15	9"	
	" #16	9"	
20' 0"		3"	

Column Clamp Spacing

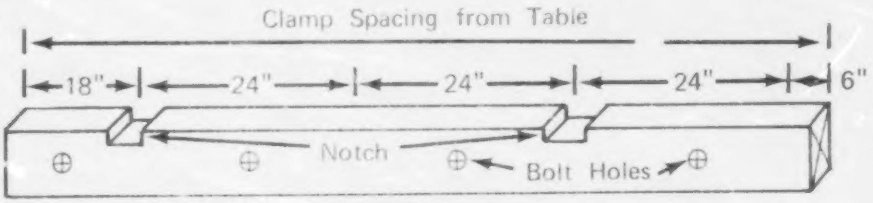
5. Cut required number of segments

(CAUTION: Mark the first segment TEMPLATE and use it for layout of remaining segments.)

6. Cut studs to length; notch and drill bolt holes (Figure 5)

(NOTE: Notches should be placed at clamp spacing as determined from the schedule. Bolt spacing should be at approximately two feet center to center. Be sure all studs are notched and drilled in identical location.)

FIGURE 5



7. Nail segments together to form a half circle (Figure 6)

   (NOTE: Stagger joints by starting second layer using one-half of the segment.)

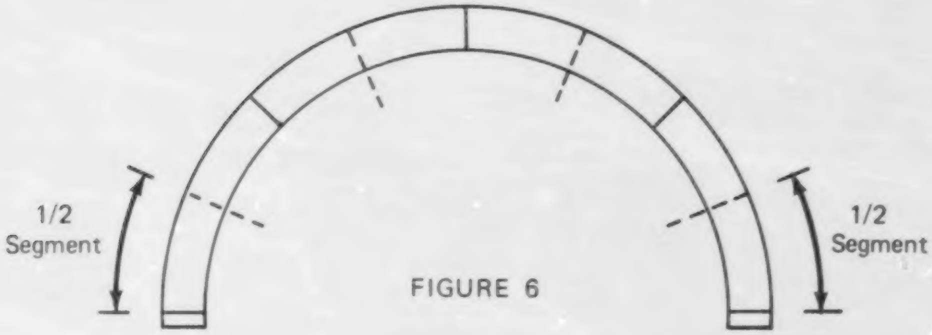

1/2
Segment
1/2
Segment

FIGURE 6

8. Attach segments to studs (Figure 7)

   (NOTE: Use light predrilled angle iron and screws.)

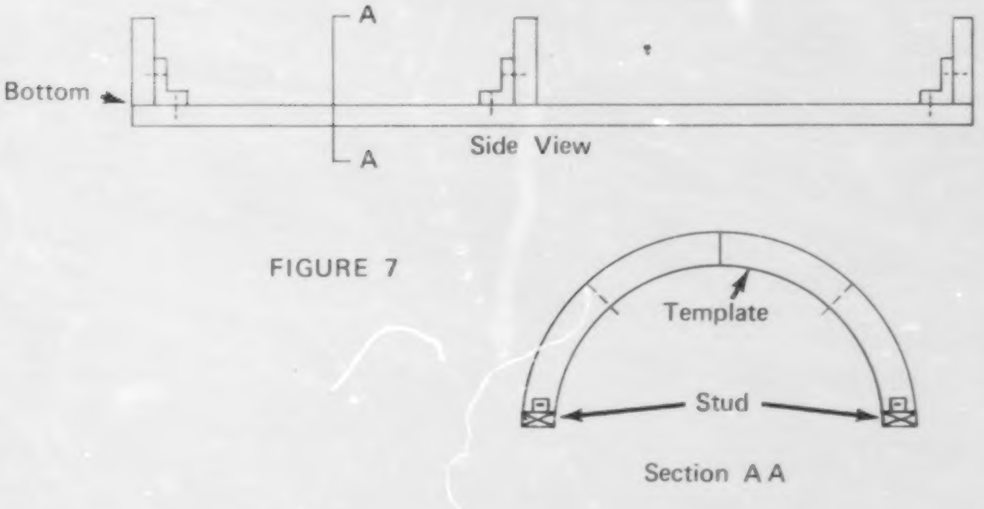
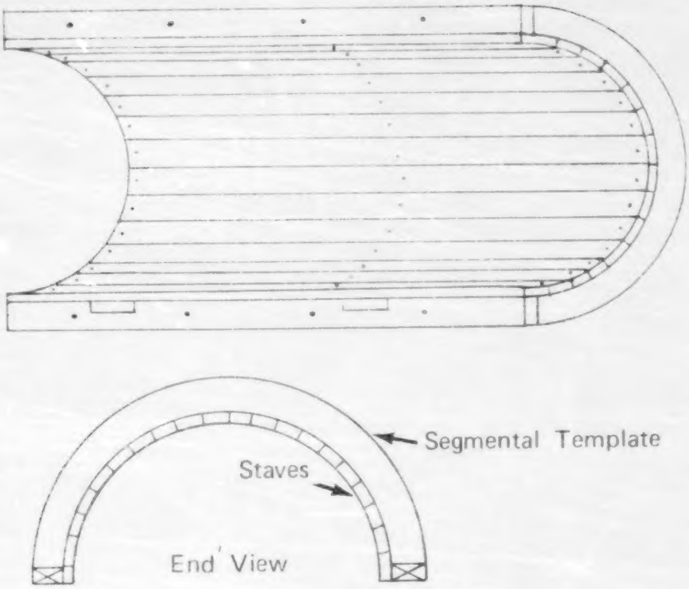

A
A
Bottom
Side View
Template
Stud
Section A A

FIGURE 7

JOB SHEET #1

9. Nail staves to segments (Figure 8)

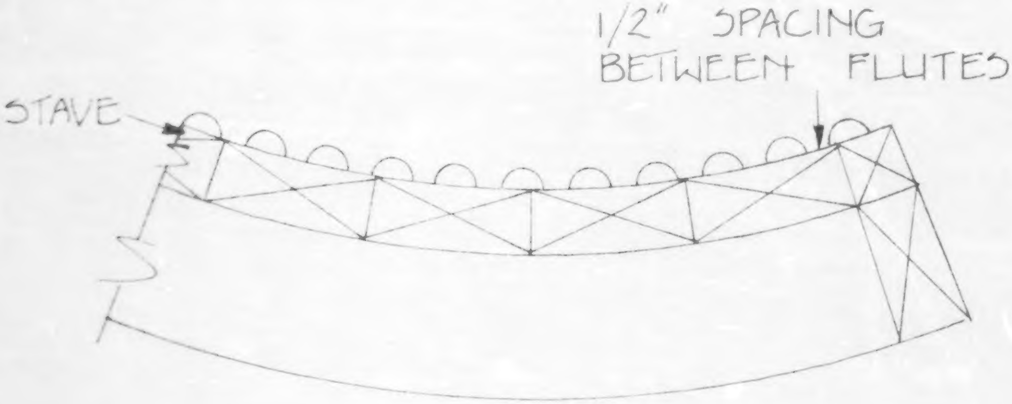
FIGURE 8


Segmental Template
Staves
End View

10. Nail half round wood to staves (Figure 9)

(NOTE: On the job, the size and spacing of the flutes are taken from the architect's plans.)

FIGURE 9


1/2" SPACING BETWEEN FLUTES
STAVE

JOB SHEET #1

11. Apply liberal coat of form oil to form

    (NOTE: This column has an architectural surface. Be sure the form oil is the nonstaining type.)

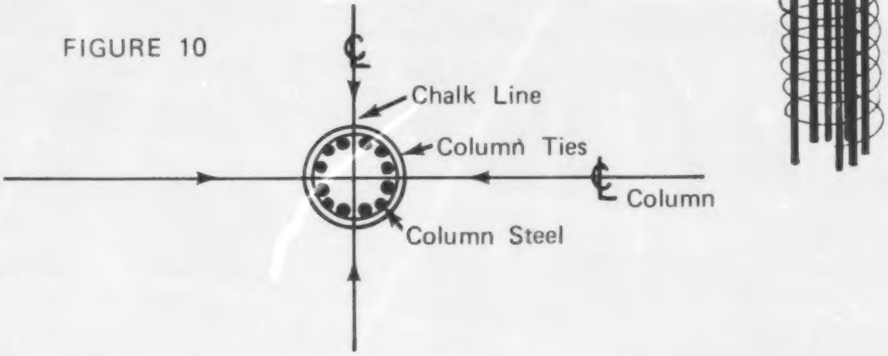
B. Set forms

(NOTE: Column steel should be set complete.)

1. Establish center line of column both directions (Figure 10)

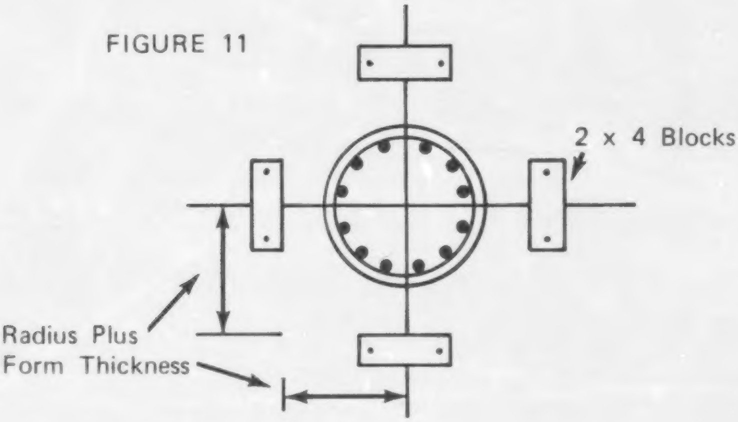
   (NOTE: Center lines may be established with a string line. Snap a chalk line in the column area.)

FIGURE 10


℄
Chalk Line
Column Ties
℄ Column
Column Steel

2. Locate the outside of the form and nail template blocks to the floor (Figure 11)

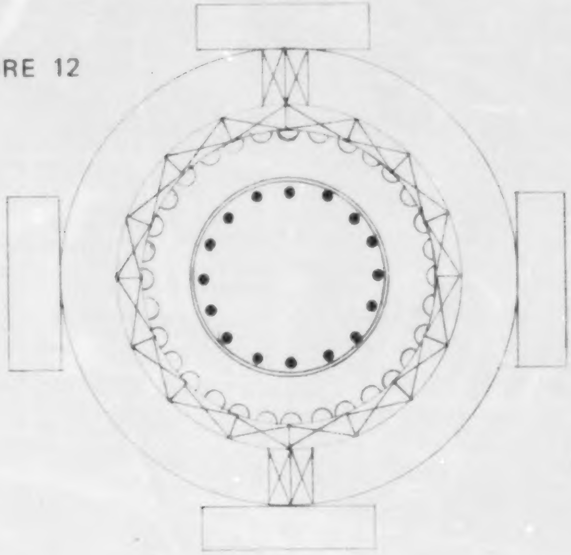
FIGURE 11


2 x 4 Blocks
Radius Plus
Form Thickness

JOB SHEET #1

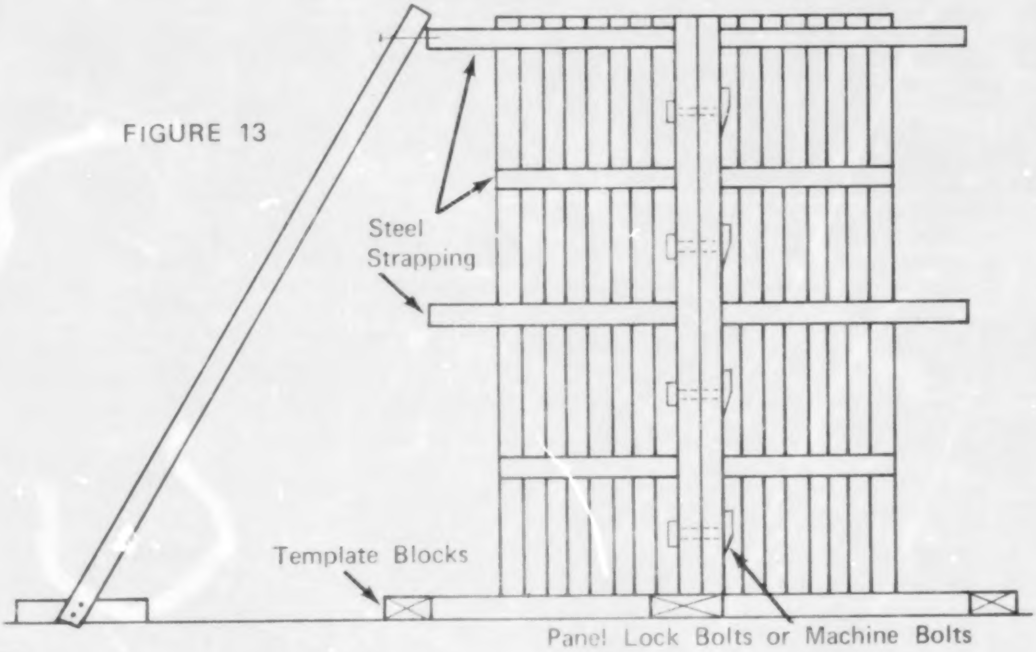
3. Set form halves in position inside the floor templates (Figure 12)

FIGURE 12



4. Bolt sections together (Figure 13)

FIGURE 13


Steel
Strapping
Template Blocks
Panel Lock Bolts or Machine Bolts

JOB SHEET #1

5. Place blocks under form and install steel strapping around template rings

   (NOTE: Form should be blocked up high enough to install strapping on bottom segmental template.)

6. Thread strapping through notches in studs and tighten, using strap wrench

7. Brace form plumb as shown in Figure 13

   (NOTE: Two braces placed at quarter sections of the form should be sufficient.)

VERTICAL PIERS AND COLUMNS
UNIT VI

JOB SHEET #2--CONSTRUCT FORMS FOR A SQUARE COLUMN

I. Tools and materials

   A. Tools

      1. Hammer, 16 oz or larger
      2. Handsaw, crosscut
      3. Electric handsaw
      4. String line
      5. Electric drill and bits
      6. Level, hand, 30"
      7. Framing square
      8. Chalk line
      9. Brush, mop, or roller

   B. Materials

      1. Sheathing plywood
      2. Studs, 2 x 4's
      3. Column clamps
      4. Form oil
      5. Nails
         a. 6d duplex
         b. 16d duplex
         c. Concrete

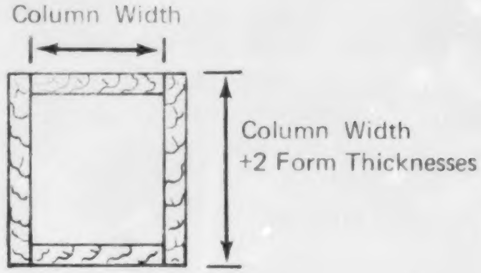
II. Procedure

   A. Determine size of column

JOB SHEET #2

B. Cut column sides to size (Figure 1)

FIGURE 1

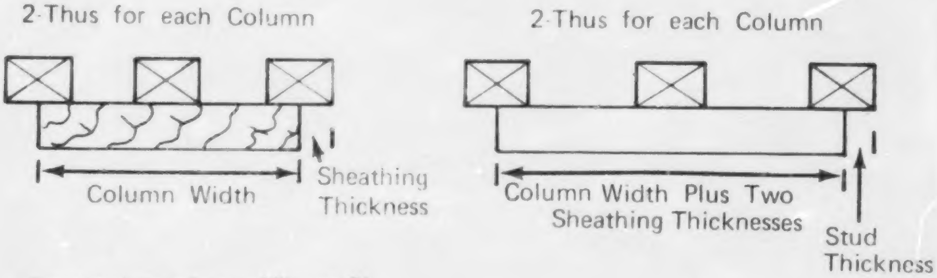

Column Width
Column Width
+2 Form Thicknesses

C. Cut column studs

(NOTE: Studs will be the same length as the beam side.)

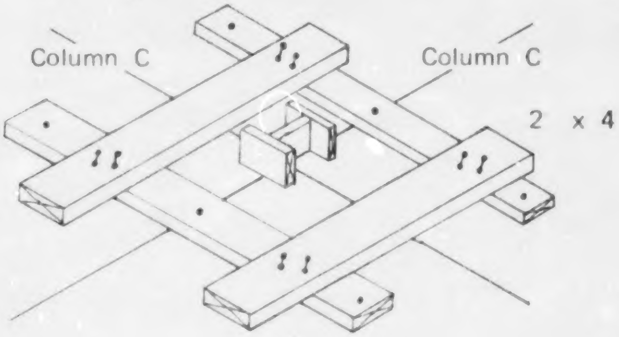
D. Assemble column sides (Figure 2)

FIGURE 2


2-Thus for each Column
Column Width
Sheathing Thickness
2-Thus for each Column
Column Width Plus Two Sheathing Thicknesses
Stud Thickness

E. Erect column forms (Figure 3)

FIGURE 3


Column C
Column C
2 x 4

1. Coat forms with form oil
2. Lay out column center lines

1118

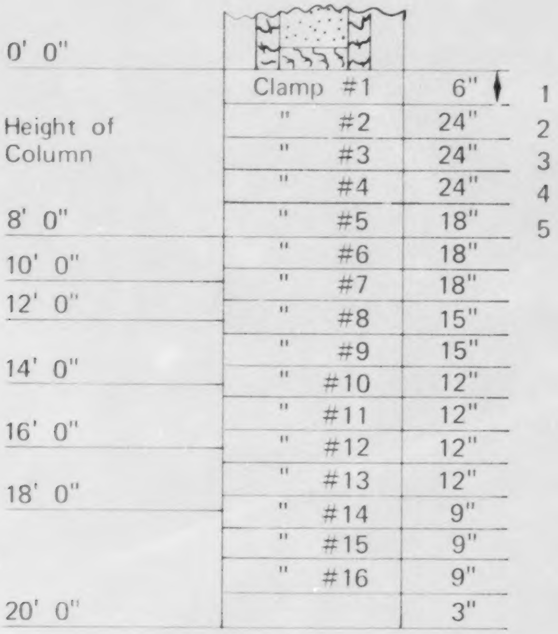
JOB SHEET #2

3. Nail column template to floor

   (NOTE: Template should be the same size as the outside of the column form.)

4. Determine column clamp spacing (Figure 4)

FIGURE 4



Clamp #1	6"
" #2	24"
" #3	24"
" #4	24"
" #5	18"
" #6	18"
" #7	18"
" #8	15"
" #9	15"
" #10	12"
" #11	12"
" #12	12"
" #13	12"
" #14	9"
" #15	9"
" #16	9"
	3"

Column Clamp Spacing

5. Lay out template for column clamp spacing

   (NOTE: All steel must be completely in place.)

6. Stand opposing column sides in template and nail corner studs

   (NOTE: Use duplex nails.)

7. Stand the other two sides in template and nail as in step 6

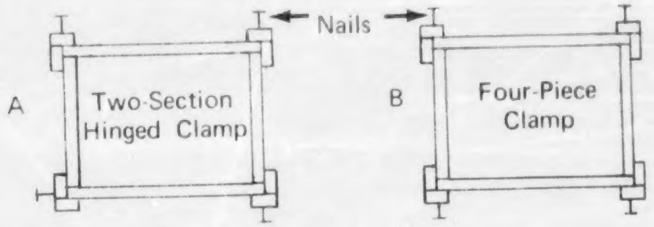
8. Stand template at column corners and mark column clamp locations on corner studs

JOB SHEET #2

9. Drive a 16d duplex nail at each mark (Figures 5a and 5b)

(NOTE: These nails serve to support the clamps during installation. Check the type of clamp being used for side locations of nails.)

FIGURE 5


Nails
A
Two-Section Hinged Clamp
B
Four-Piece Clamp

10. Lay sections of column clamps on nails and secure wedges

11. Brace form plumb in both directions

VERTICAL PIERS AND COLUMNS
UNIT VI

JOB SHEET #3--SET A ROUND COLUMN (FIBERBOARD TUBE)

I. Tools and materials

   A. Tools

      1. Electric handsaw
      2. Handsaw, crosscut
      3. Claw hammer, 16 oz or larger
      4. Folding rule or tape
      5. Framing square
      6. Level, hand, 30"
      7. Plumb bob

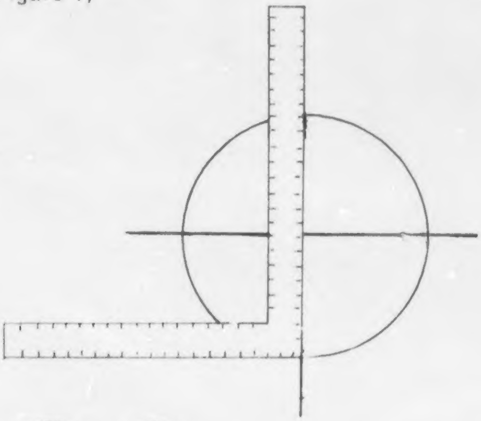
   B. Materials

      1. Fiberboard tube, 36" x 12'
      2. Braces, 2 x 4's
      3. Templates, 2 x 4's
      4. Nails
         a. Concrete
         b. 16d

II. Procedure

   A. Lay out column (Figure 1)

FIGURE 1



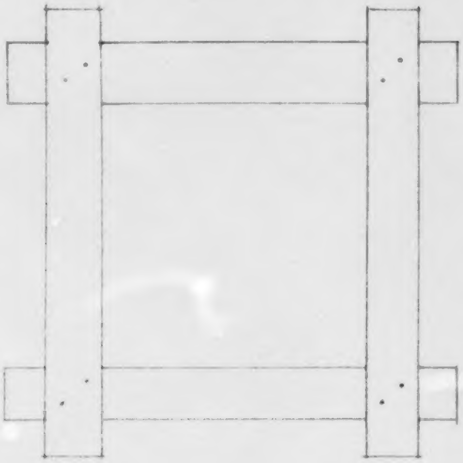
JOB SHEET #3

1. Establish center lines
2. Mark center lines on floor using a framing square
3. Mark center lines on column form at top and bottom

B. Prepare form for setting

1. Cut 2 x 4's and build templates (Figure 2)

FIGURE 2



2. Nail templates together and mark center lines on the one that will be used at the bottom

   (NOTE: The number of templates depends on size and height of form.)

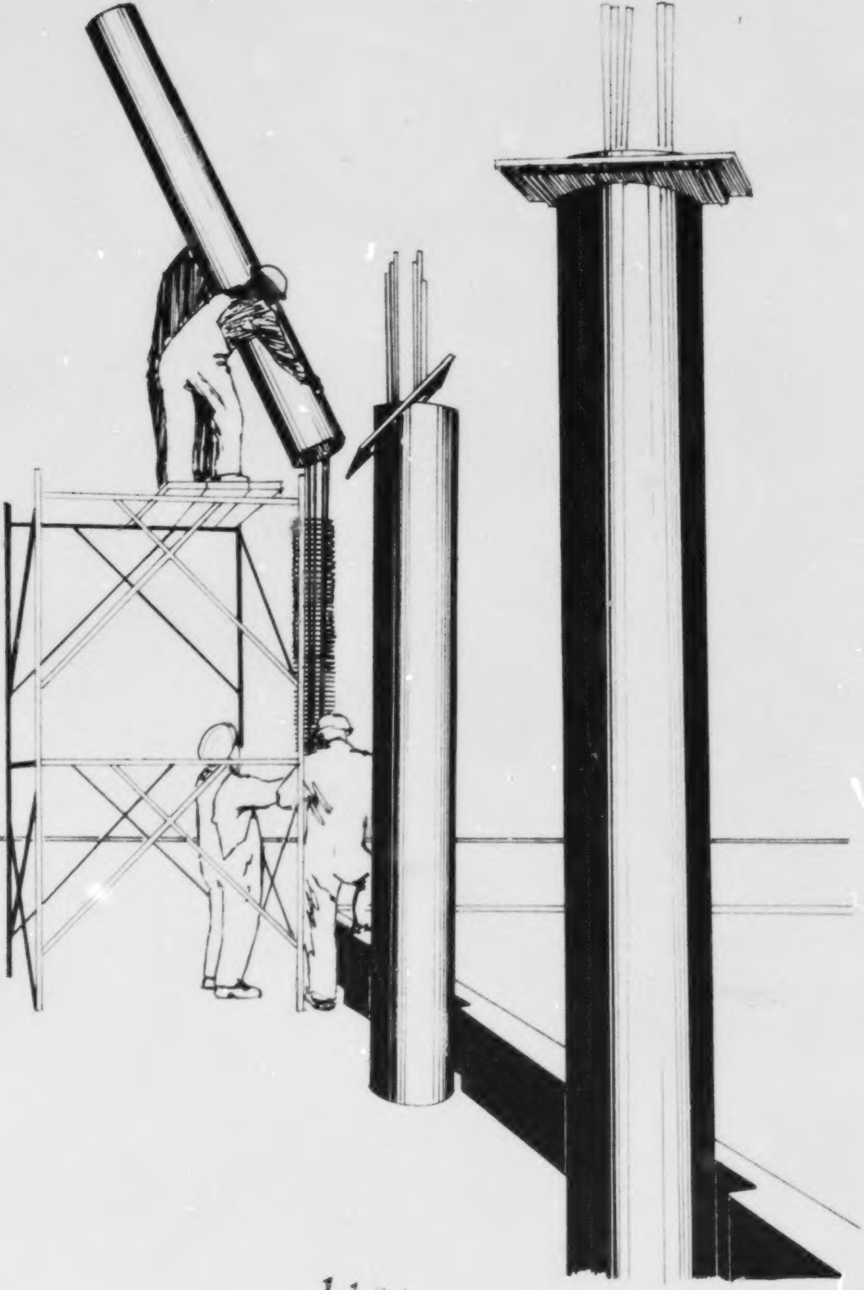
C. Set form

(NOTE: A scaffold will have to be set up alongside of column location in order to lift form over reinforcing steel. See Figure 3 on next page.)

1. Lift form up and over steel and carefully work it down to the floor (Figure 3)
2. Slip templates over form and toenail one at top and bottom of form
3. Line up center marks on bottom template with marks on floor and nail this template to the floor

JOB SHEET #3

FIGURE 3



JOB SHEET #3

D. Plumb and brace form (Figure 4)

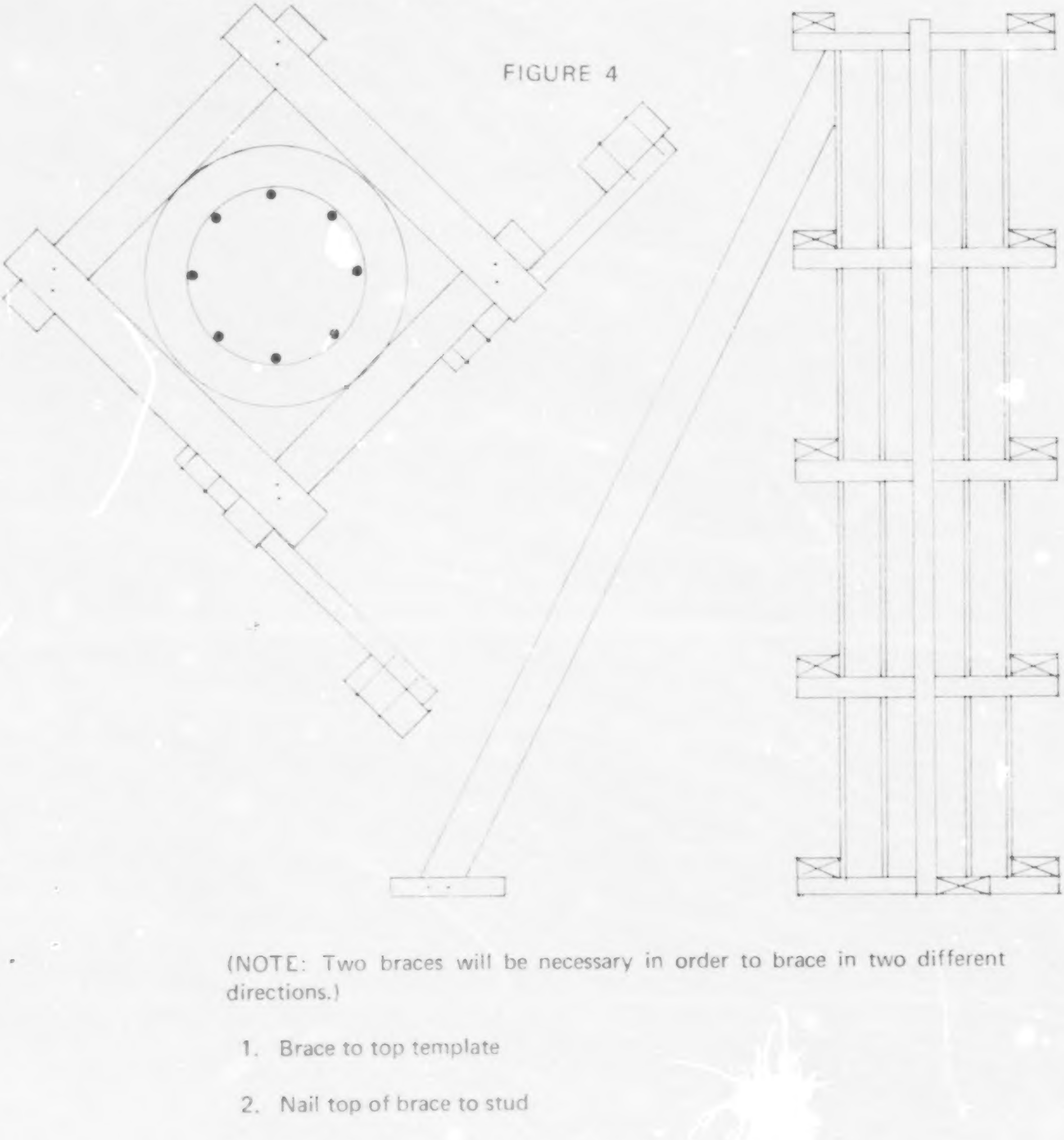


FIGURE 4

(NOTE: Two braces will be necessary in order to brace in two different directions.)

1. Brace to top template
2. Nail top of brace to stud
3. Plumb column in both directions using plumb bob
4. Nail brace to 2 x 4 at bottom

CC - 331-G

VERTICAL PIERS AND COLUMNS
UNIT VI

TEST

NAME ________________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Manufactured device surrounding a column form to hold the pressure exerted by wet concrete

______b. Level of finished concrete in a form

______c. Wide boards, plywood, or metal that make up the face of a form

______d. Enlarged area at the top of a column

______e. Job-built device surrounding a column form to hold the pressure exerted by wet concrete

______f. Support for an arch or a supporting section of wall between two openings

______g. Vertical shaft of many shapes designed to support the structure above

______h. Vertical sheathing in a circular column form

______i. Wire or metal crosstie used to hold the pressure of wet concrete and maintain the proper wall thickness

______j. Temporary brace attached to the back of forms to help support them when lifting and moving them

______k. Straight line passing through the center of a circle or sphere and terminating in the circumference

______l. Straight line radiating from the center of a circle or sphere to the circumference; semidiameter of a circle or sphere

______m. Gauge used as a pattern for copying or making identical parts

1. Pier
2. Capital
3. Column
4. Staves
5. Sheathing
6. Yoke
7. Grade point
8. Column clamp
9. Strongback
10. Form tie
11. Template
12. Radius
13. Diameter

______n. Strips that form channels or grooves; used to decorate columns, especially in classical architecture

______o. To arrange in uneven lines, one row alternating with the spaces of another row

______p. Tapered piece of wood or metal

______q. Reinforcing rod shaped in round coils (like a spring) and tied to the vertical steel

______r. Wrench that is used to tighten and hold band steel until it is secured

14. Wedge
15. Strap wrench
16. Stagger joints
17. Flutes
18. Column steel

2. Identify the column shapes below and on the next page by writing the correct names in the blanks provided.

a. ______________________________

b. ______________________________

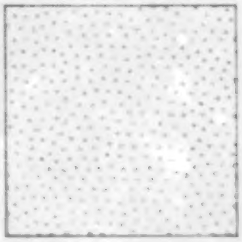
c. ______________________________

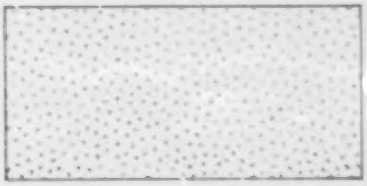
d. ______________________________

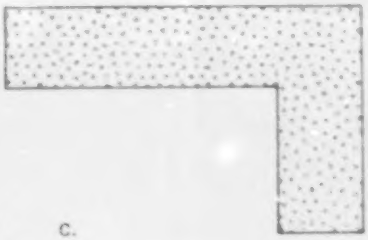
e. ______________________________

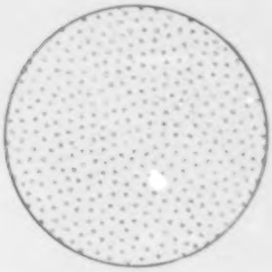
f. ______________________________

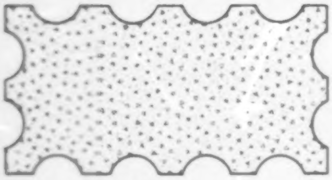
g. ______________________________


a.

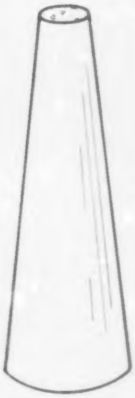

b.


c.

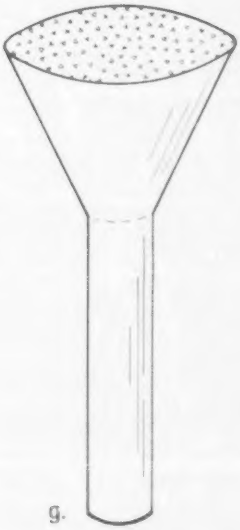

d.



e.



f.



g.

3. Name materials normally used for column forms.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

4. Name methods of column form construction.

a. ____________________

b. ____________________

5. Demonstrate the ability to:
   - a. Construct forms for a round fluted column.
   - b. Construct forms for a square column.
   - c. Set a round column (fiberboard tube).

     (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

VERTICAL PIERS AND COLUMNS
UNIT VI

ANSWERS TO TEST

1. a. 8
   b. 7
   c. 5
   d. 2
   e. 6
   f. 1
   g. 3
   h. 4
   i. 10
   j. 9
   k. 13
   l. 12
   m. 11
   n. 17
   o. 16
   p. 14
   q. 18
   r. 15
2. a. Square
   b. Rectangular
   c. L-shaped
   d. Round
   e. Fluted
   f. Tapered
   g. Capitaled
3. a. Plywood
   b. Metal
   c. Fiber (paper)
   d. Molded fiberglass
4. a. Job-built
   b. Manufactured panels
5. Performance skills evaluated to the satisfaction of the instructor

HORIZONTAL BEAM FORMS
UNIT VII

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the parts of a beam form. The student should be able to name the various types of beams and materials used to build their forms. The student should also be able to name methods of shoring and one type of beam form that does not require shoring. The student should be able to construct a spandrel beam form, an interior beam form, and an inverted beam form post-tensioned. This knowledge will be evidenced by completion of job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with horizontal beam forms to the correct definitions.
2. Identify the parts of a beam form.
3. Name types of beams.
4. Name materials used to construct beam forms.
5. Name methods of shoring beams.
6. Define *steel plate girder*.
7. Demonstrate the ability to:
    a. Construct a spandrel beam form.
    b. Construct an interior beam form.
    c. Construct an inverted beam form post-tensioned.

HORIZONTAL BEAM FORMS
UNIT VII

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

- A. Provide students with objective sheet.
- B. Provide students with information and job sheets.
- C. Make transparencies.
- D. Discuss unit and specific objectives.
- E. Discuss information sheet.
- F. Demonstrate and discuss procedures outlined in job sheets.
- G. Give test.

II. Instructional materials:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
    1. TM 1--Parts of a Beam Form
    2. TM 2--Types of Beams
    3. TM 3--Wood T Shore with Wedges
    4. TM 4--Wood T Shore with Manufactured Clamps
    5. TM 5--Patented Shore
    6. TM 6--Patented Shore Scaffold
    7. TM 7--Beam Without Intermediate Shoring
- D. Job sheets
    1. Job Sheet #1--Construct a Spandrel Beam Form
    2. Job Sheet #2--Construct an Interior Beam Form
    3. Job Sheet #3--Construct an Inverted Beam Form Post-Tensioned
- E. Test
- F. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

B. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Ciffs, New Jersey: Prentice Hall, Inc., 1970.

C. Prestressed Concrete Institute. *Slide Lecture No. 4: Post-Tensioned Prestressed Concrete.* Prestressed Concrete Institute, 20 North Wacker Drive, Chicago, Illinois 60606.

HORIZONTAL BEAM FORMS
UNIT VII

INFORMATION SHEET

I. Terms and definitions

A. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure

B. Nail point tie--Form tie with one end bent 90° and pointed

C. Scab--Piece of material nailed across a splice to strengthen and hold it together

D. Spreader--Piece of wood that is used to hold the sides of the forms apart and is removed as the concrete is poured; may also be an integral part of a form tie

E. Cleat--Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

F. Shore--Prop placed against or beneath an object for support

G. Shore head--Horizontal timber placed across a shore and braced squarely

H. Beam bottom--That part of the beam form which supports the vertical pressure

I. Kicker--Piece of material used to resist horizontal pressure

J. Spandrel beam--Beam spanning between two structures to support the structure above

K. Stringer--Piece of heavy material placed across several shores; horizontal or inclined supporting member

L. Tendon--Single or multistrand of high tensile wire or a rod used to stress concrete

M. Post-tensioning--Process of introducing internal stresses after the concrete has reached a predetermined strength

N. Mud sill--Horizontal timber laid directly on the ground to support a frame structure

O. Form oil--Paraffin oil or other manufactured product used on a form to prevent adhesion of concrete to the form

P. Ribbon--Horizontal board used to hold shores in alignment and to resist lateral movement

INFORMATION SHEET

- Q. Wedge--Tapered piece of wood or metal
- R. Beam side--Stud frame and sheathing section which comprise the vertical section of a beam form
- S. Sill--Usually a large piece of wood, layed flat on the floor, on which the scaffolds or shores are set
- T. Tie holes--Holes that are exposed in the concrete when the form snap ties are removed
- U. Waler--Horizontal brace used in form construction
- V. Shore jack--Tool used to jack up some patented shores

II. Parts of a beam form (Transparency 1)

- A. Top plate
- B. Stud
- C. Sheathing
- D. Beam side
- E. Beam bottom
- F. Bottom plate
- G. Kicker
- H. Stringer
- I. Shore head
- J. Brace
- K. Ribbon
- L. Shore
- M. Wedge
- N. Mud sill

III. Types of beams (Transparency 2)

- A. Spandrel
- B. Interior
- C. Invertec

INFORMATION SHEET

IV. Materials used to construct beam forms

   A. Wood

   B. Metal

   C. Molded fiberglass

V. Methods of shoring beams (Transparencies 3, 4, 5, and 6)

   A. Wood T shore with wedges

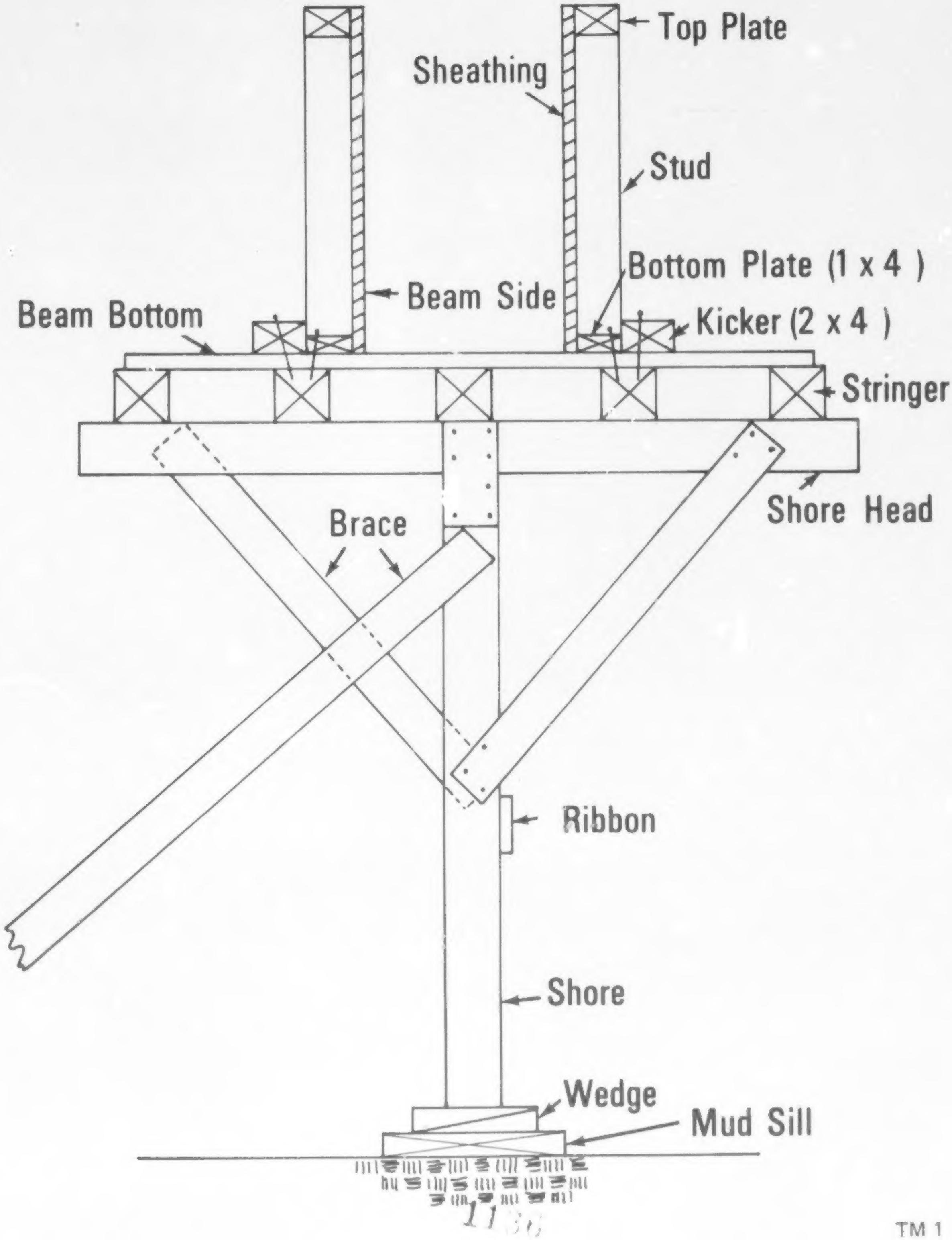
   B. Wood T shore with manufactured clamps

   C. Patented shore

   D. Patented shore scaffold

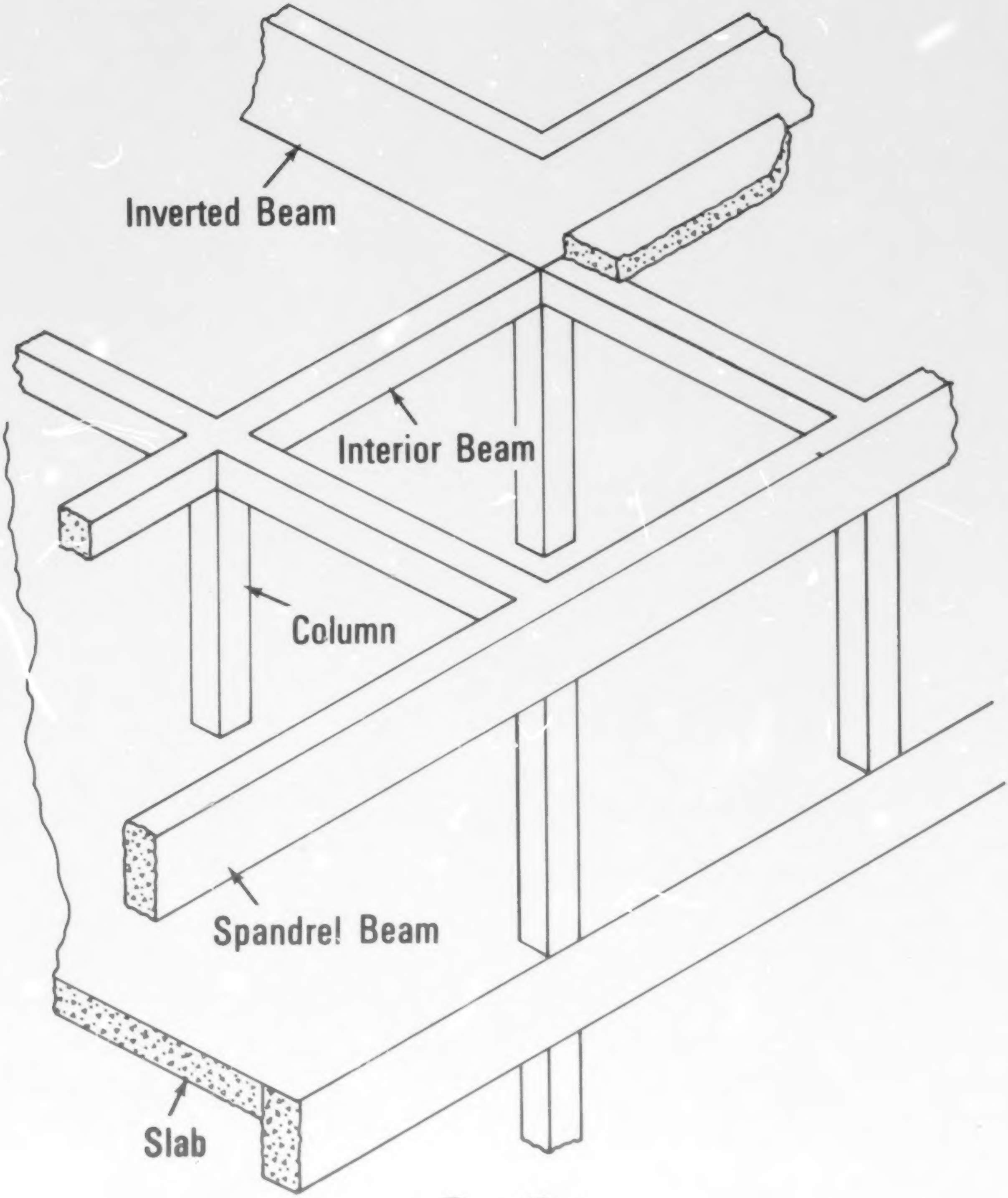
VI. Steel plate girder--Type of beam form that does not require intermediate shoring (Transparency 7)

Parts of a Beam Form


Top Plate
Sheathing
Stud
Bottom Plate (1 x 4)
Beam Side
Kicker (2 x 4)
Beam Bottom
Stringer
Shore Head
Brace
Ribbon
Shore
Wedge
Mud Sill

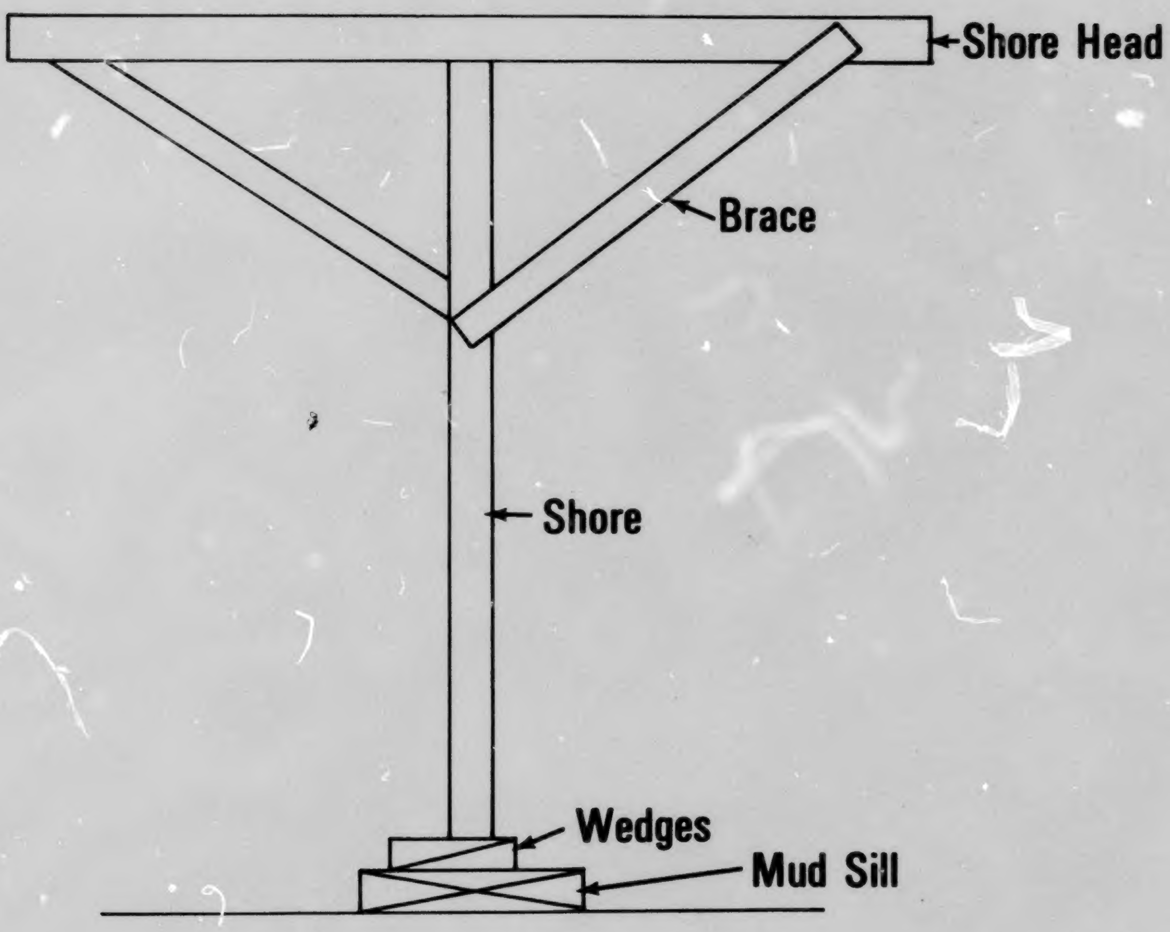
1136

Types of Beams

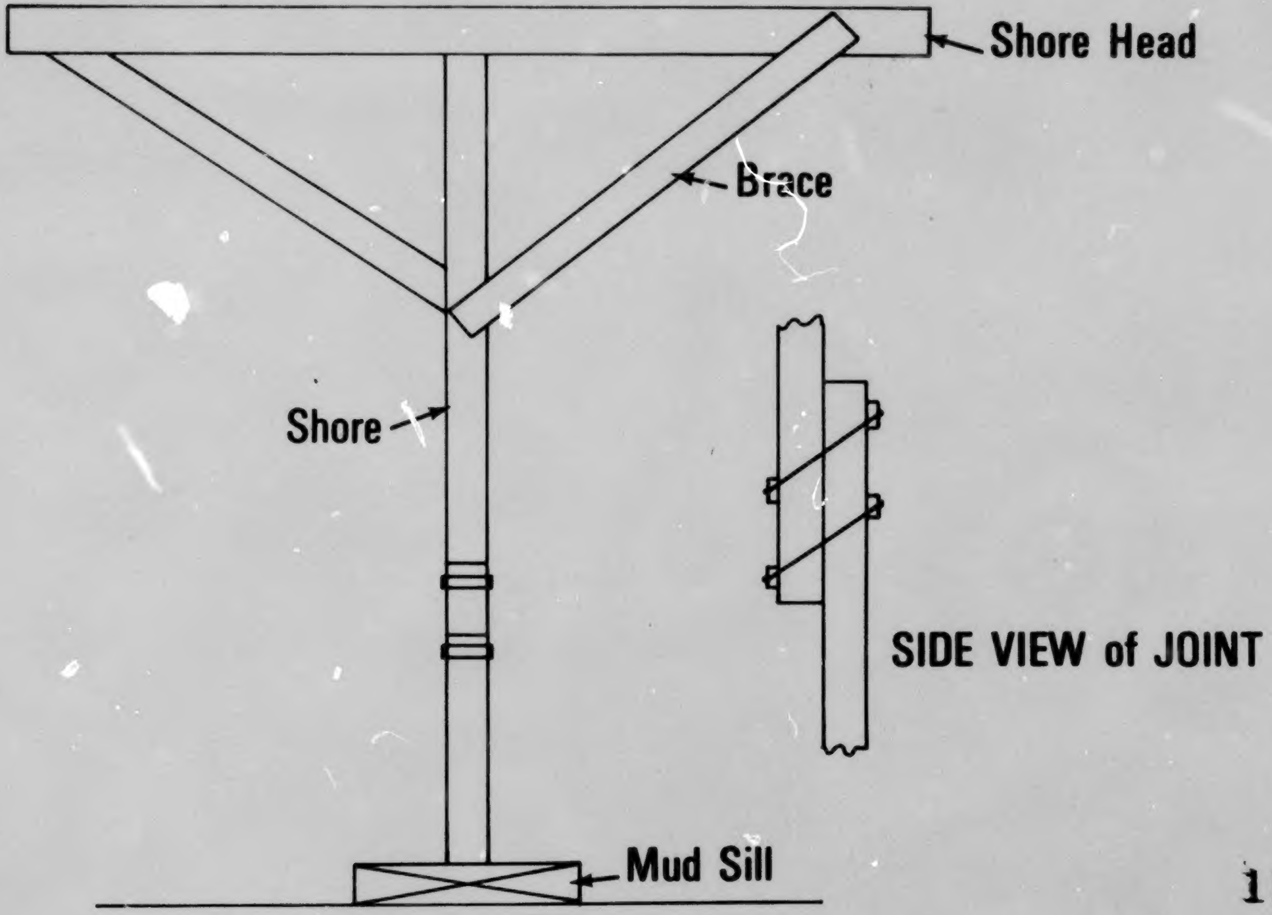

Inverted Beam
Interior Beam
Column
Spandrel Beam
Slab

1137

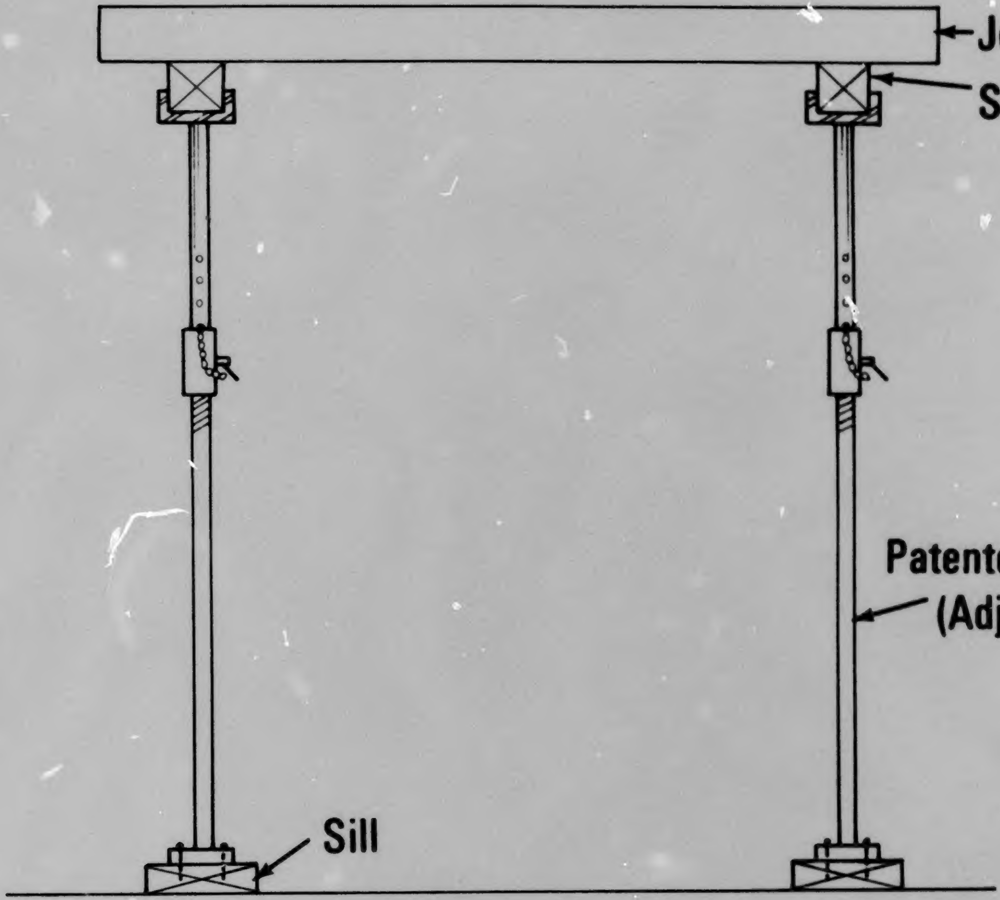
Wood T Shore with Wedges


Shore Head
Brace
Shore
Wedges
Mud Sill

Wood T Shore with Manufactured Clamps


Shore Head
Brace
Shore
Mud Sill
SIDE VIEW of JOINT

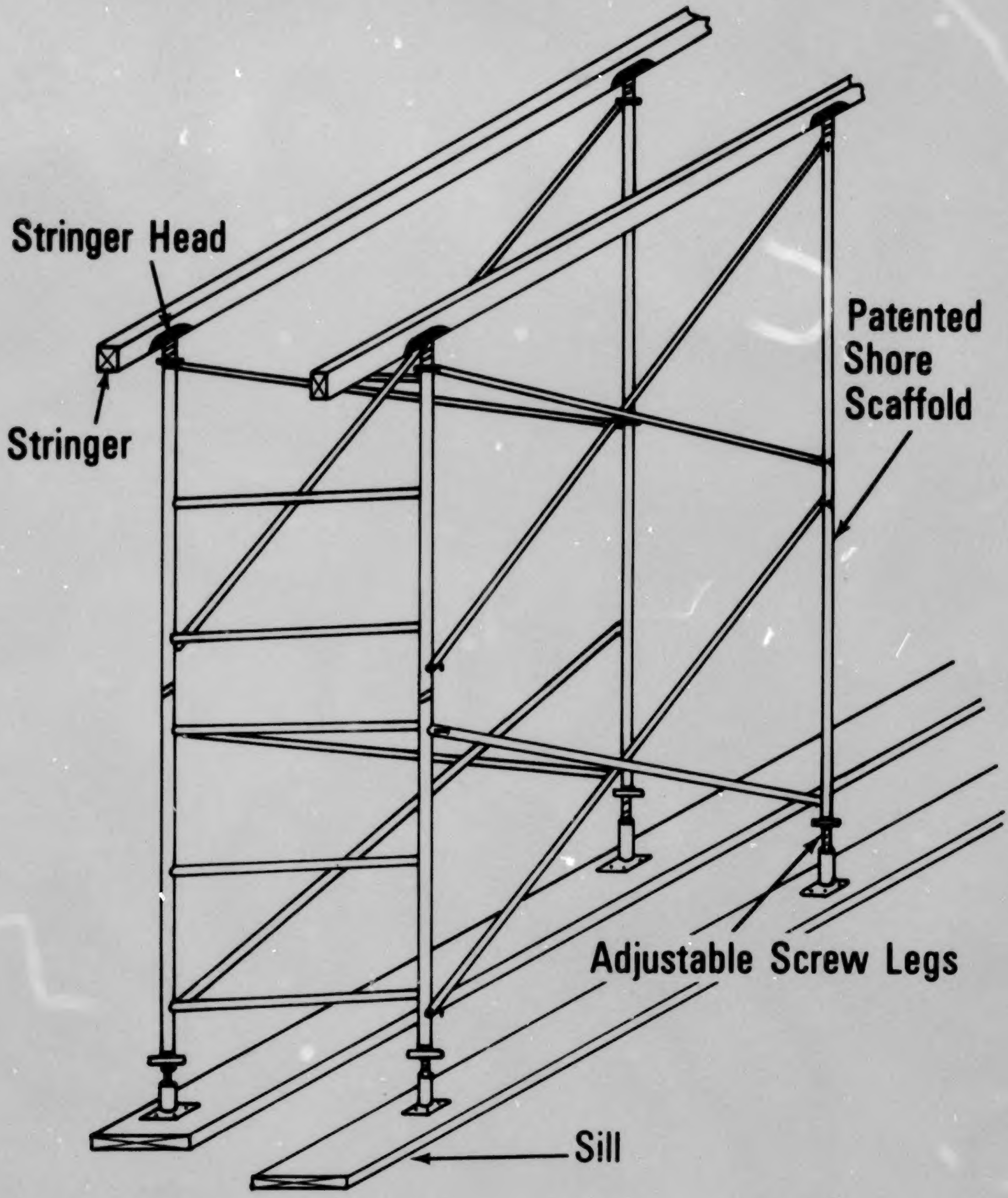
Patented Shore


Joist
Stringer
Patented Shores (Adjustable)
Sill

1142

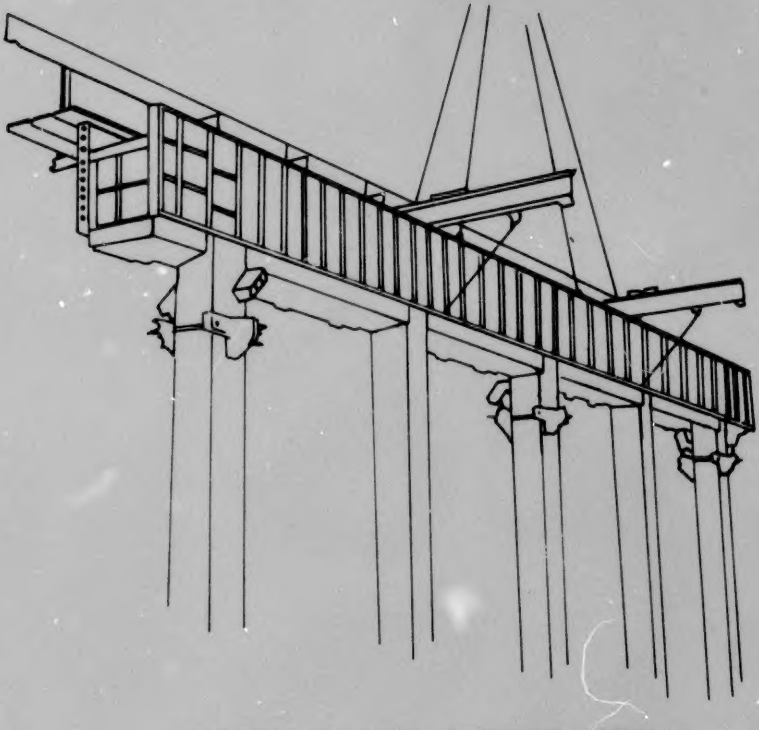
1143

Patented Shore Scaffold


Stringer Head
Stringer
Patented Shore Scaffold
Adjustable Screw Legs
Sill

CC - 357-G

Beam Without Intermediate Shoring



STEEL PLATE GIRDER FORM

TM 7

HORIZONTAL BEAM FORMS
UNIT VII

JOB SHEET #1--CONSTRUCT A SPANDREL BEAM FORM

I. Tools and materials

A. Tools

1. Claw hammer, 16 oz or larger
2. Handsaw, crosscut
3. Electric handsaw
4. Plumb bob
5. Level, hand, 30"
6. String line
7. Electric drill, 1/4" or 3/8"
8. Drill bits
9. Framing square
10. Chalkline

B. Materials

1. Nail point ties
2. Sheathing, plywood
3. 2 x 4's for studs, upper plates, kickers, and walers
4. 4 x 4's or larger for shores
5. 4 x 4's or 4 x 6's for stringers
6. 2 x 10's or larger for sills
7. Patented shore clamps
8. 1 x 4's for bottom plate and braces
9. Form ties
10. Nails

JOB SHEET #1

II. Procedure

A. Determine beam size

(NOTE: On the job, this information will be secured from the structural plans and beam schedule.)

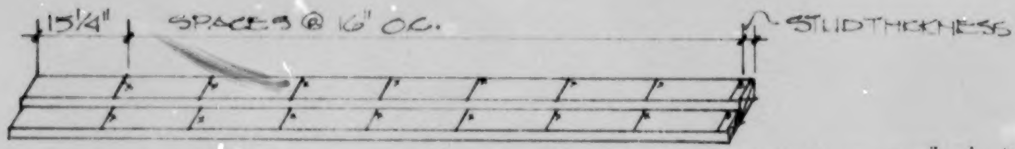
B. Fabricate beam sides

1. Cut plywood to proper width
2. Cut studs and plates to length

   (NOTE: Deduct thickness of top and bottom plates from beam side height to get stud length.)

3. Lay out stud spacing on plates (Figure 1)

FIGURE 1

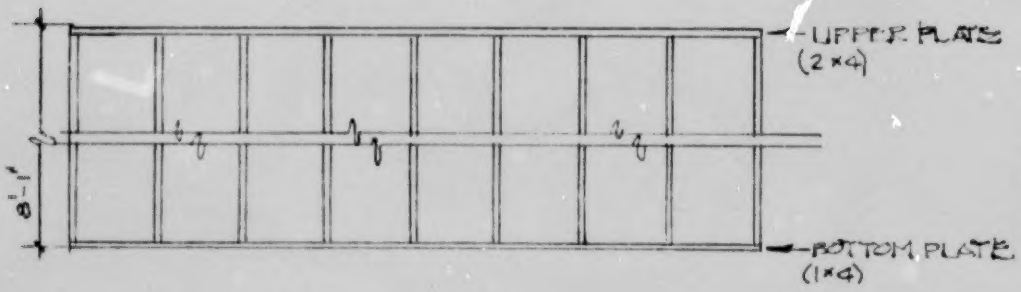

15¼"
SPACES @ 16" O.C.
STUD THICKNESS

SCALE: 3/8" = 1'-0"

4. Nail studs to plate (Figures 2a and 2b)

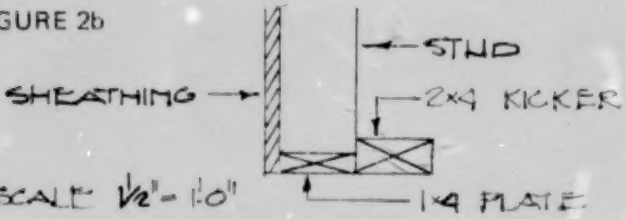
   (NOTE: A one-inch plate is used on the bottom so the studs will bear against the kicker. See Figure 2b.)

FIGURE 2a


UPPER PLATE
(2×4)
8'-1"
BOTTOM PLATE
(1×4)

SCALE 3/8" = 1'-0"

FIGURE 2b


STUD
SHEATHING
2×4 KICKER
1×4 PLATE
SCALE 1/2" = 1'-0"

JOB SHEET #1

5. Nail sheathing to stud frame

   (NOTE: Sheathing should be flush with all four edges of stud frame.)

6. Build required number of beam sides following steps one to five

C. Drill form tie holes

1. Figure waler and tie spacing from table below (Figure 3)

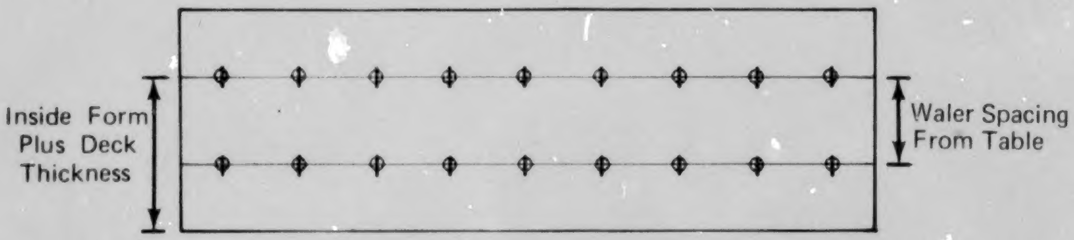
FIGURE 3

At 50° Temperature				For 3/4" Sheathing, 2x4 Studs, Double 2x4 Waler		At 70° Temperature		
2'	3'	4'	5'	Rate of Pour (Vertical Feet per Hour)	2'	3'	4'	5'
21"	18"	18"	16"	Stud Spacing for Safe Value of Sheathing	24"	21"	18"	18"
30"	27"	24"	24"	Waler Spacing for Safe Value of Studs	33"	30"	27"	27"
30"	24"	24"	18"	Tie Spacing for Safe Value of Waler	36"	30"	27"	24"

2. Lay out and drill form tie holes using spacing obtained from the table (Figure 4)

   (NOTE: Top row of ties should be the height of the inside form plus deck thickness.)

FIGURE 4



3. Drill form tie holes and use the first beam side drilled for a pattern

   (NOTE: The inside beam side will only have one row of tie holes.)

JOB SHEET #1

D. Build T shores

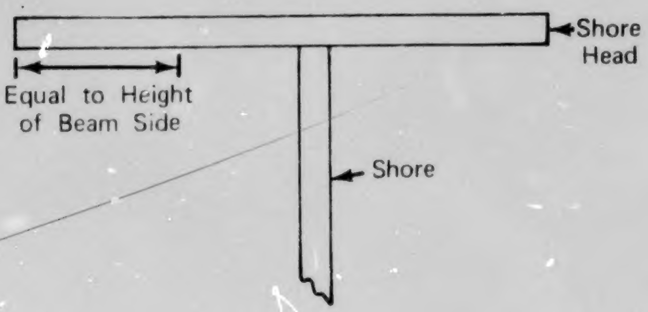
1. Cut 4 x 4's to length

   (NOTE: Shore pieces must be cut to have a minimum of a two-foot lap.)

2. Lay shore heads at end of shores and at a right angle to the shore (Figure 5)

   (NOTE: Shore head should be off center of the shore to facilitate installation and bracing of outer beam side.)

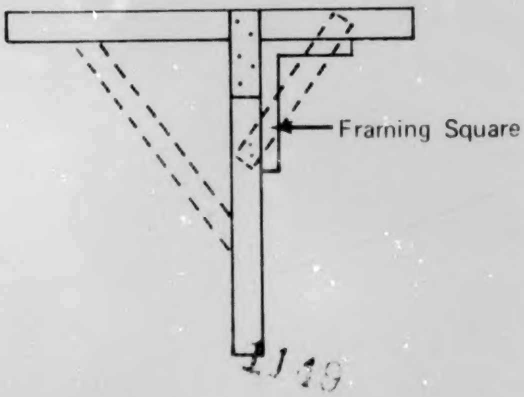
FIGURE 5


Shore Head
Equal to Height of Beam Side
Shore

3. Square shore head on shore and nail scab across joint (Figure 6)

   (NOTE: Use 2 x 4 scab and 16d duplex nails.)

FIGURE 6


Framing Square

JOB SHEET #1

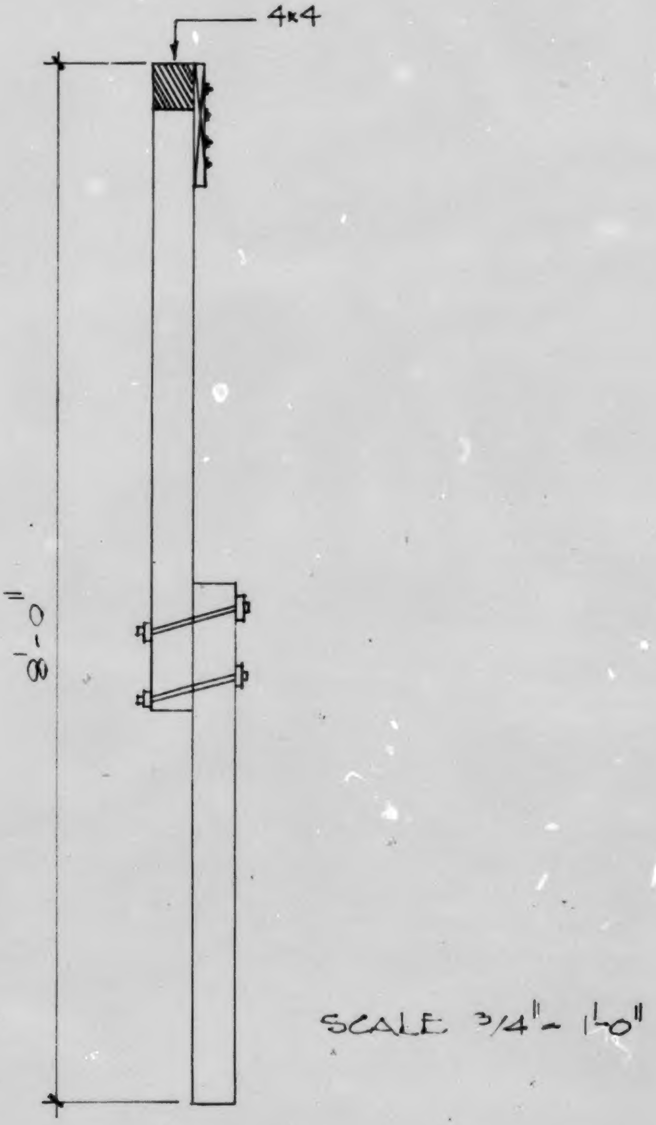
4. Install braces as shown by dotted lines in Figure 6

   (NOTE: Check relationship of shore head and shore with framing square.)

5. Join the two pieces of shore with patented clamps (Figure 7)

   (NOTE: Check for approximate shore length and tighten clamps.)

FIGURE 7



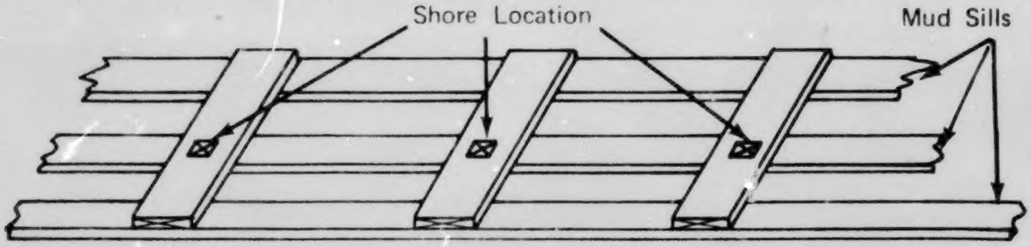
JOB SHEET #1

E. Erect shores and beam form

1. Lay mud sills on center line of beam (Figure 8)

   (NOTE: If ground is not stable, cross another line of mud sill at shore locations.)

FIGURE 8



2. Nail stringer to two shore heads directly over shore

   (NOTE: The shore at the column end should be held back approximately one foot from the end of the stringer. The other shore should have the stringer end centered on the shore head.)

3. Stand assembled unit upright on mud sills and brace plumb in both directions

   (NOTE: When setting upper floors, use a single sill at the beam center line. This will permit anchorage at the base of the shore

4. Proceed with steps 2 and 3 until entire length of beam is shored

JOB SHEET #1

5. Install remaining stringers (Figures 9a and 9b)

   (NOTE: Side stringers should be installed at beam edges and in position to receive nails through kicker. Stringers do not have to be cut as they can be lapped on the shore head.)

FIGURE 9a

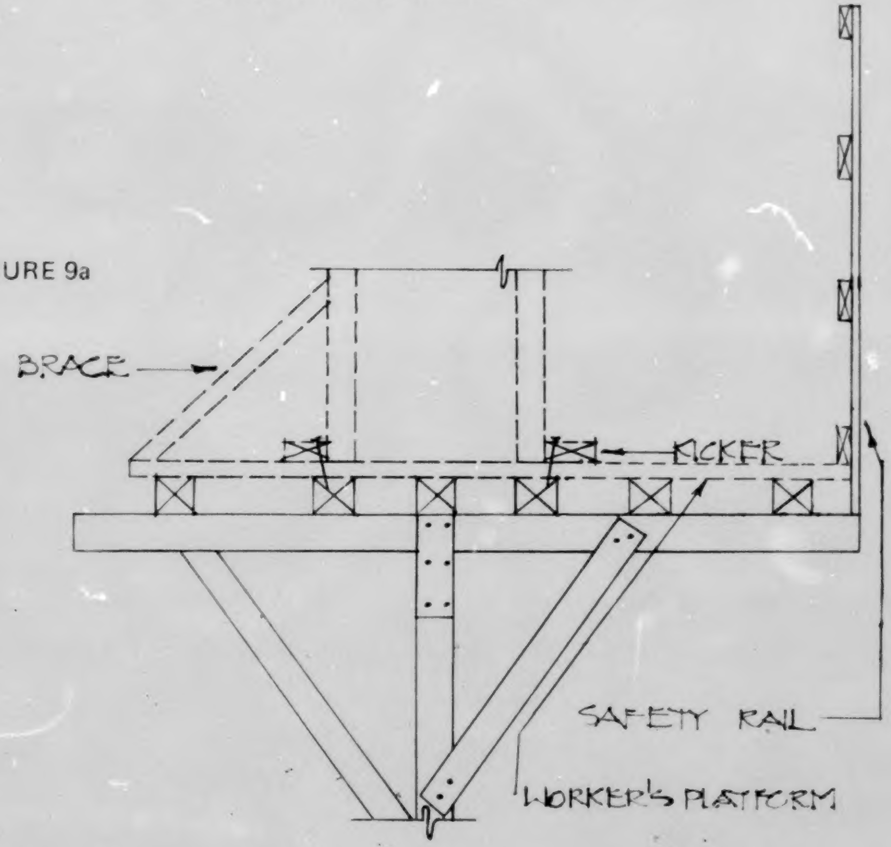
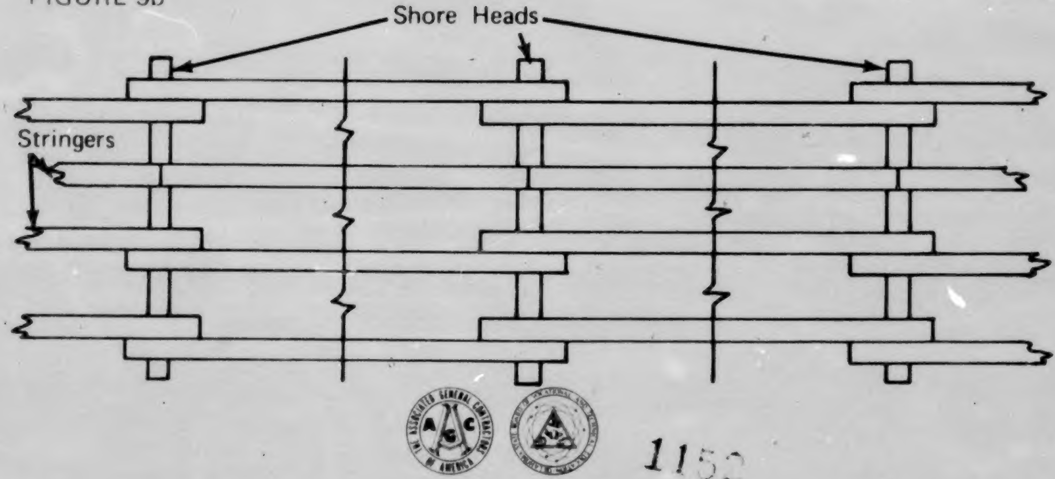

BRACE
KICKER
SAFETY RAIL
WORKER'S PLATFORM

FIGURE 9b


Shore Heads
Stringers

1152

JOB SHEET #1

6. Nail plywood decking to the stringers the entire length of the beam

   (NOTE: This decking should be wide enough to provide walkway for workers and safety rails where required.)

7. Snap chalk lines on the plywood locating both sides of the beam

8. Stand beam sides on plywood and nail through plywood to stringer

   (NOTE: If stringers were lapped as shown in Figure 9b, short stringers which cross at least two shore heads might have to be added to facilitate nailing of the form or kicker.)

9. Brace to approximate line by plumbing beam side with a hand level

   (NOTE: If spreader ties are used, be sure to install them after the first beam side is set.)

F. Install kickers

(NOTE: Kickers may be installed prior to beam side installation if it is more convenient to do so.)

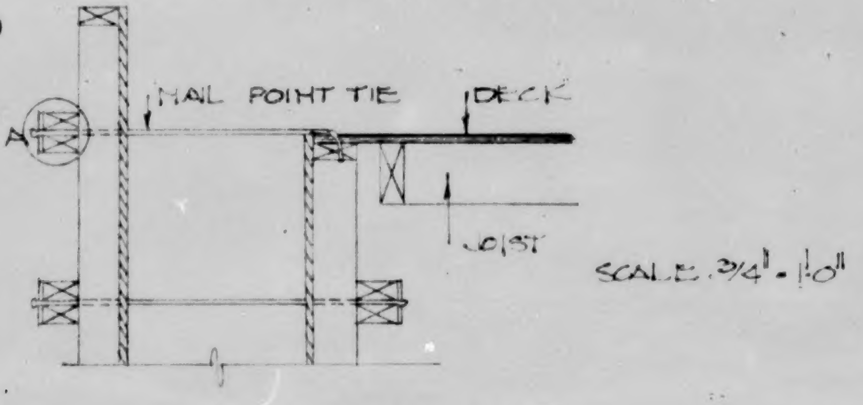
G. Install walers on the rows of ties below the row of nail point ties at this time

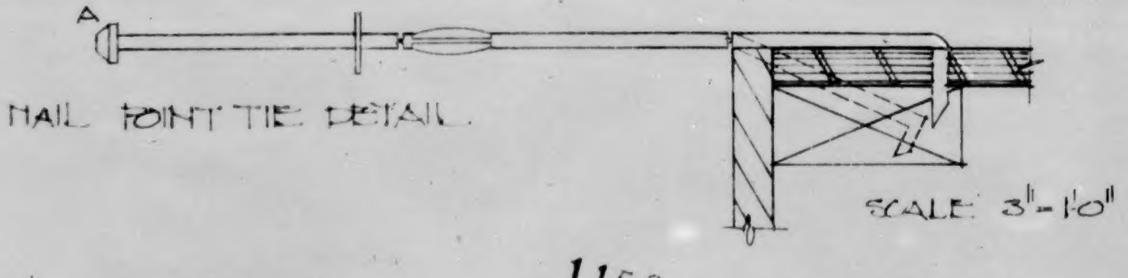
H. Secure all form tie heads

I. Install and secure row of nail point ties and align beam side (Figure 10)

(NOTE: This row of ties is installed after the deck is installed on top of the inner beam side. Use string line to align top of beam side.)

FIGURE 10



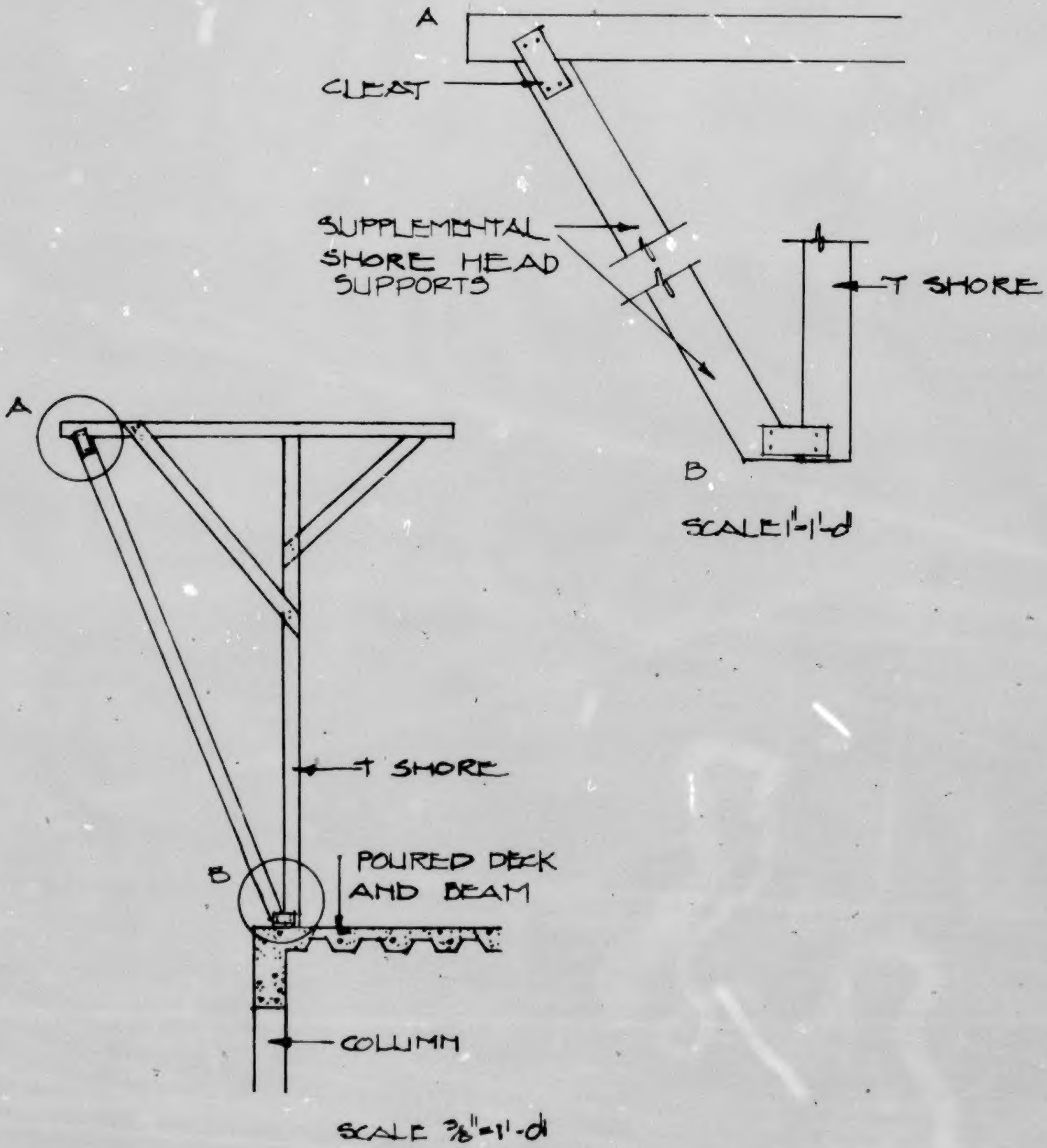


JOB SHEET #1

J. Install supplemental shore head supports (Figure 11)

(NOTE: This is generally necessary only on the second floor and above.)

FIGURE 11


A
CLEAT
SUPPLEMENTAL SHORE HEAD SUPPORTS
T SHORE
B
SCALE 1"-1'-0"
A
T SHORE
B
POURED DECK AND BEAM
COLUMN
SCALE 3/8"=1'-0"

HORIZONTAL BEAM FORMS
UNIT VII

JOB SHEET #2--CONSTRUCT AN INTERIOR BEAM FORM

I. Tools and materials

- A. Tools
    1. Claw hammer, 16 ounce or larger
    2. Handsaw, crosscut
    3. Electric handsaw
    4. Plumb bob
    5. Level, hand, 30"
    6. String line
    7. Shore jack
- B. Materials
    1. Sheathing, plywood
    2. 2 x 4's for kickers
    3. Patented shores
    4. 2 x 8's or larger for sills
    5. 2 x 10's for beam bottom
    6. Nails

II. Procedure

- A. Determine beam size

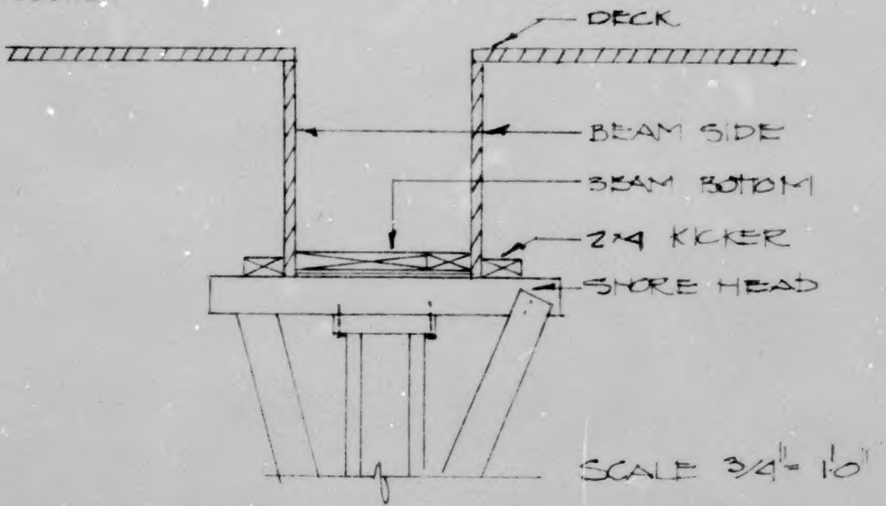
  (NOTE: On the job, this information will be secured from the structural plans and beam schedule.)

JOB SHEET #2

B. Cut plywood to width for beam sides (Figure 1)

(NOTE: When figuring beam side widths, be sure to add beam bottom thickness and deduct decking thickness.)

FIGURE 1

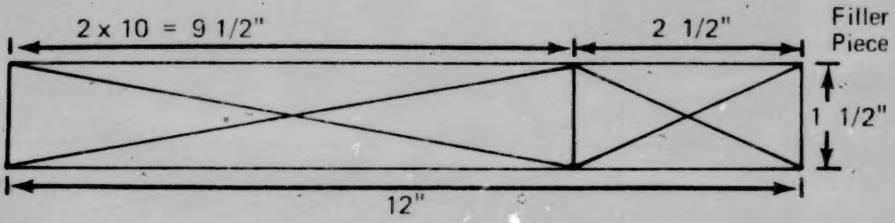

DECK
BEAM SIDE
BEAM BOTTOM
2x4 KICKER
SHORE HEAD
SCALE 3/4" = 1'0"

C. Build beam bottom

1. Cut filler piece to correct width (Figure 2)

(NOTE: Figure correct width of material to rip with the least waste. It is better to cut two pieces from one piece if the waste is less. Straight material should be used.)

FIGURE 2


2 x 10 = 9 1/2"
2 1/2"
Filler Piece
1 1/2"
12"

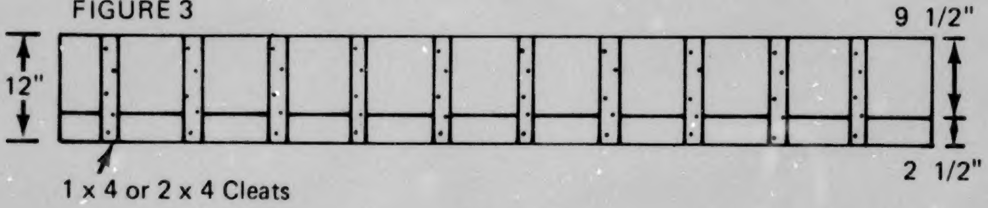
(NOTE: If a 2 x 4 was used to cut the 2 1/2" piece, there would be 1" waste; if two pieces 2 1/2" wide are cut from a 2 x 6, there would be less than 1/2" waste.)

JOB SHEET #2

2. Cleat the pieces together (Figure 3)

   (NOTE: Space cleats to miss shore location.)

FIGURE 3


9 1/2"
12"
2 1/2"
1 x 4 or 2 x 4 Cleats

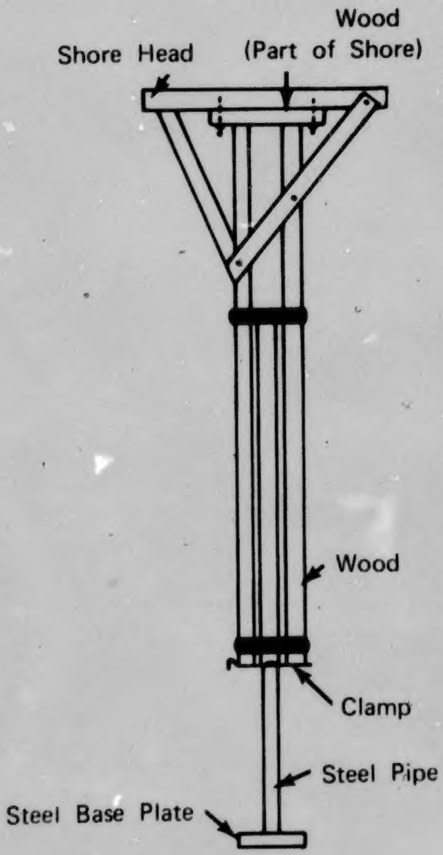
D. Build T shores

1. Cut shore heads

   (NOTE: If braces are needed on beam side, shore heads will have to be long enough to receive the bottom end of the brace.)

2. Nail shore head to shore (Figure 4)

FIGURE 4


Shore Head
Wood
(Part of Shore)
Wood
Clamp
Steel Pipe
Steel Base Plate

JOB SHEET #2

3. Install shore head braces

   (NOTE: Make sure bottom of the brace does not interfere with upper pipe guide when shores are adjusted to height.)

E. Erect shores, beam bottom, and beam sides

1. Lay sill pieces on the deck at beam center line

2. Nail beam bottom to two T shores

   (NOTE: The shore at the column should be held back approximately one foot from the end of the beam bottom. The other end of the beam bottom will be centered on the shore head.)

3. Stand the assembly upright on the sill and brace plumb in both directions

   (NOTE: If beam bottom is too heavy to handle as outlined in steps 2 and 3, erect T shores individually; then install beam bottom.)

4. Erect intermediate shores

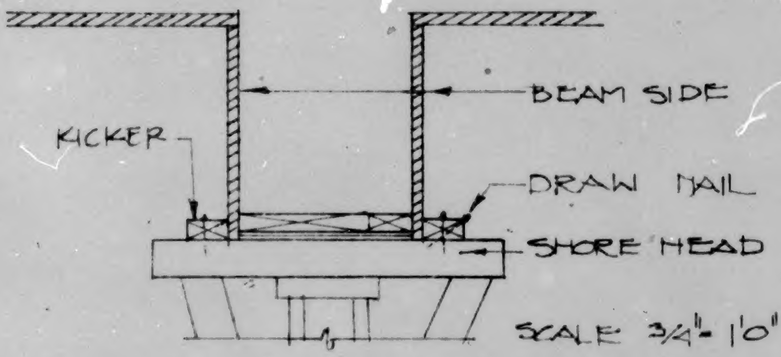
5. Nail beam sides to beam bottom

   (NOTE: Nailing should be held to a minimum. Nailing that is done should be between shore heads. In this location, the nails help hold the concrete pressure on the beam bottom.)

6. Nail continuous kicker to shore heads (Figure 5)

   (NOTE: Kicker should be nailed tightly against beam side. Use draw nails if necessary.)

FIGURE 5



7. Plumb, align, and install kicker at top of beam sides after slab decking has been installed

HORIZONTAL BEAM FORMS
UNIT VII

JOB SHEET #3--CONSTRUCT AN INVERTED BEAM FORM POST-TENSIONED

I. Tools and materials

  A. Tools

    1. Claw hammer, 16 oz or larger
    2. Handsaw, crosscut
    3. Electric handsaw
    4. Plumb bob
    5. Level, hand
    6. String line
    7. Electric drill, 1/4" or 3/8"
    8. Drill bits

  B. Materials

    1. Sheathing, plywood
    2. 2 x 4's for studs, upper plates, kickers, and walers
    3. Patented scaffold shores
    4. 4 x 4's or 4 x 6's for stringers
    5. 2 x 10's for sills
    6. Form ties with spreader washers
    7. Form supports, 1/2" thin wall conduit; 1/4" allthread rod
    8. 1 x 4's for bottom plates

II. Procedure

  A. Secure material

  B. Determine beam size

  (NOTE: On the job, this information will be secured from the structural plans and beam schedule.)

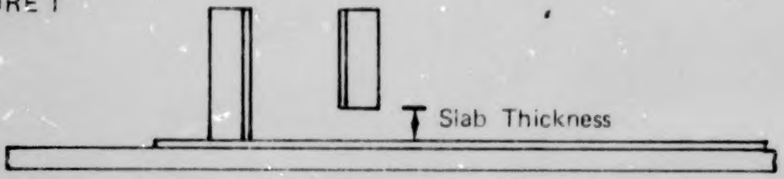
JOB SHEET #3

C. Fabricate beam sides

1. Cut plywood to proper width
2. Cut studs and plates to length (Figure 1)

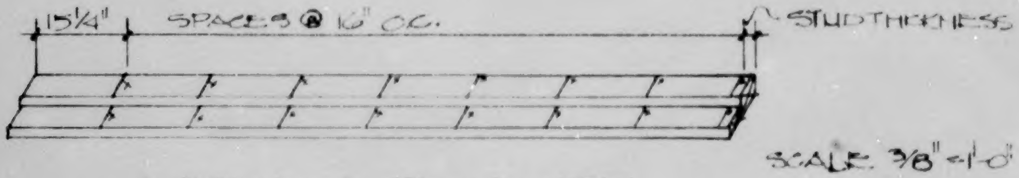
   (NOTE: Beam side heights differ by the thickness of the slab.)

FIGURE 1


Slab Thickness

3. Lay out stud spacing on plates (Figure 2)

FIGURE 2


15¼"
SPACES @ 16" O.C.
STUD THICKNESS
SCALE 3/8"=1'-0"

4. Nail studs to plate (Figures 3a and 3b)

   (NOTE: A 1" plate is used on the bottom so the studs will bear against the kicker. See Figure 3b.)

FIGURE 3a

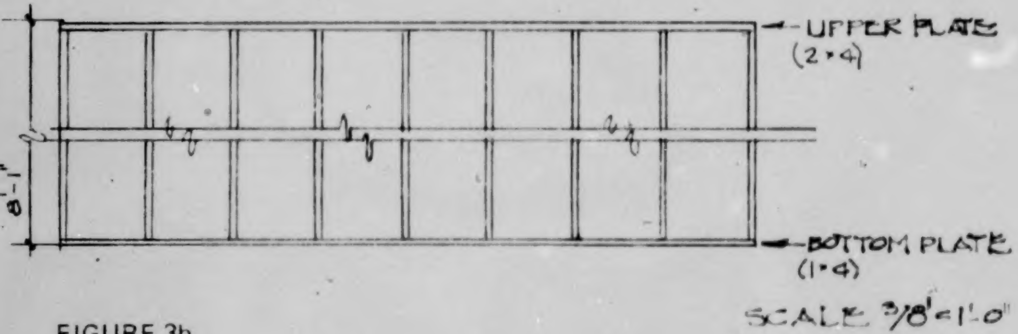
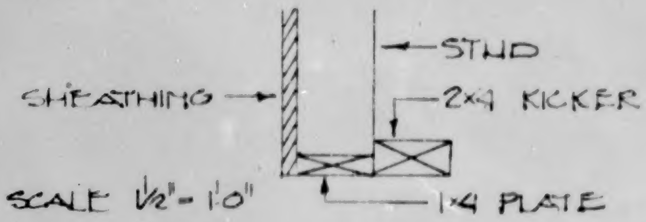

UPPER PLATE (2×4)
8'-1"
BOTTOM PLATE (1×4)
SCALE 3/8"=1'-0"

FIGURE 3b


STUD
SHEATHING
2×4 KICKER
SCALE 1/2"=1'-0"
1×4 PLATE

JOB SHEET #3

5. Nail sheathing to stud frame

   (NOTE: Sheathing should be flush with all four edges of stud frame.)

6. Build required number of beam sides following steps one to five

D. Drill form tie holes

1. Figure waler and tie spacing from table below (Figure 4)

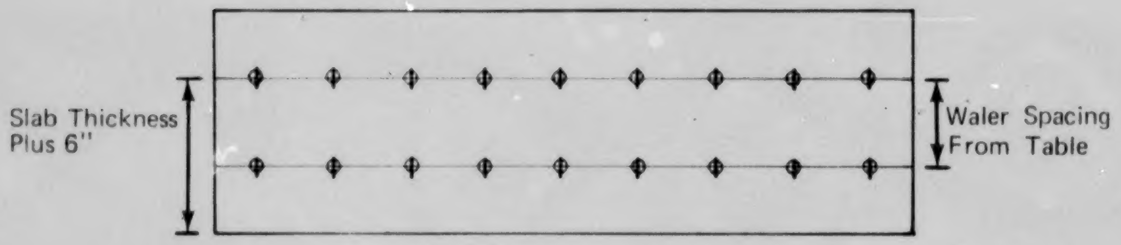
FIGURE 4

At 50° Temperature				For 3/4" Sheathing, 2x4 Studs, Double 2x4 Waler		At 70° Temperature		
2'	3'	4'	5'	Rate of Pour (Vertical Feet per Hour)	2'	3'	4'	5'
21"	18"	18"	16"	Stud Spacing for Safe Value of Sheathing	24"	21"	18"	18"
30"	27"	24"	24"	Waler Spacing for Safe Value of Studs	33"	30"	27"	27"
30"	24"	24"	18"	Tie Spacing for Safe Value of Waler	36"	30"	27"	24"

2. Lay out and drill form tie holes using spacing obtained from the table (Figure 5)

   (NOTE: Bottom row of ties should be slab thickness plus six inches.)

FIGURE 5



JOB SHEET #3

3. Drill form tie holes in inside and outer beam side using the first beam side drilled for a pattern

E. Erect scaffold

(NOTE: The patent scaffold will actually shore the slab deck which is on the same level as the beam bottom.)

1. Lay sill pieces on the deck

   (NOTE: Sill locations should be one-half the frame width each side of the column center line.)

2. Set two adjustable screws in approximate final location

   (NOTE: Final location is one foot from column face.)

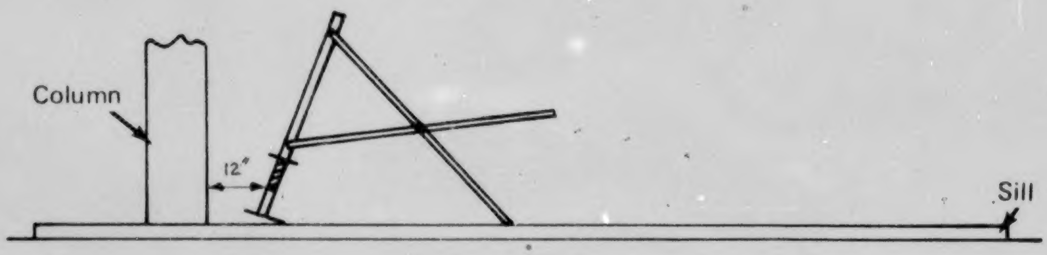
3. Attach screw legs to scaffold

   (NOTE: Screw legs must have base plates.)

4. Stand scaffold upright and attach two braces (Figure 6)

   (NOTE: Lean the scaffold and secure the top section of brace first.)

FIGURE 6



5. Attach second frame by raising brace until it aligns with pins on frame

   (NOTE: If wing nuts are used to attach braces, catch only enough threads to hold the nut on, for they will have to be removed to install the next brace.)

6. Install braces to last frame set

7. Set next frame with screw legs installed

8. Repeat steps six and seven to continue erection

JOB SHEET #3

9. Place coupling pins in top of scaffold frame

   (NOTE: Some patented scaffolds have a small bottom end which slips inside the top of the lower frame; therefore, coupling pins are not used.)

10. Place plank on top of first row of frames

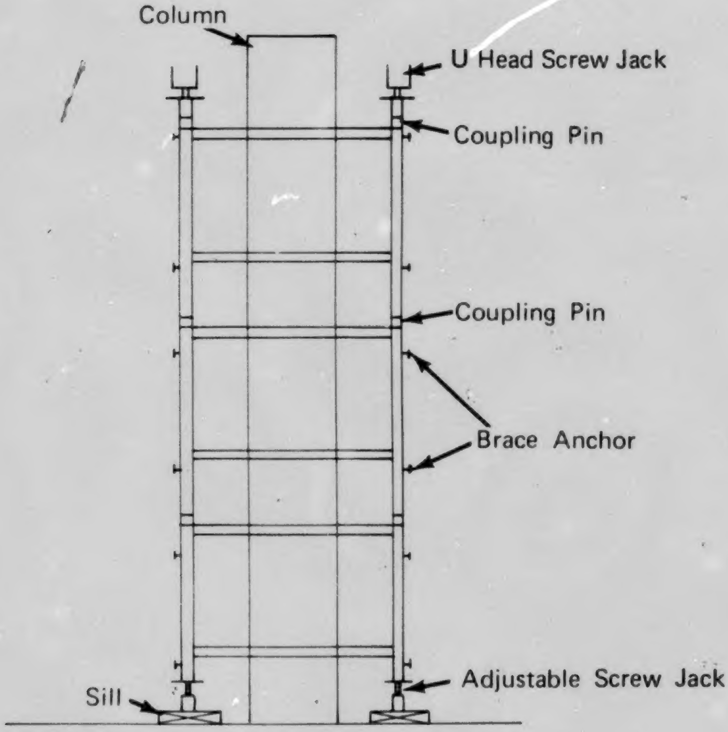
11. Set second row of frames on pins

12. Attach braces

13. Continue to set frames as outlined in steps nine, ten, eleven, and twelve until the desired height is reached

14. Install U head screw jack on all frame posts (Figure 7)

FIGURE 7


Column
U Head Screw Jack
Coupling Pin
Coupling Pin
Brace Anchor
Adjustable Screw Jack
Sill

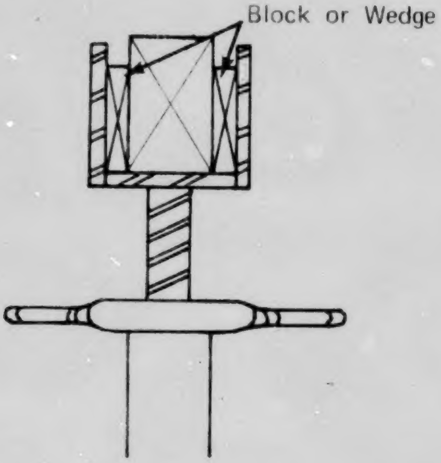
JOB SHEET #3

F. Install stringers, joist, and decking

1. Lay stringers in U head screw jack (Figure 8)

   (NOTE: If stringers are not as wide as head, block from both sides so stringer is centered.)

FIGURE 8



2. Lay joist across stringers and nail in place

   (NOTE: Project joist past the stringer at not more than four-foot intervals to facilitate beam side bracing.)

3. Nail plywood to joist

G. Install beam sides

1. Snap chalk line on deck locating face of beam

   (NOTE: Refer to Figure 1.)

2. Set widest beam side on deck
3. Line beam side with chalkline and nail to joist
4. Install kicker tightly against beam side
5. Brace beam side plumb

H. Make form supports

1. Cut conduit into lengths equal to the slab thickness

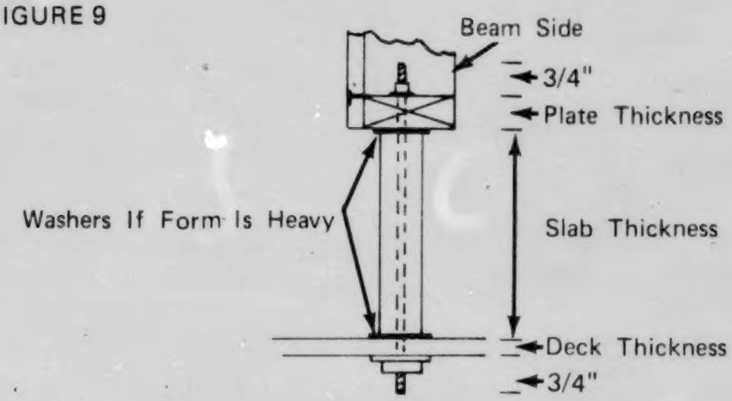
   (NOTE: If form is heavy, deduct the thickness of two 3/8" washers from the slab thickness to determine conduit length.)

JOB SHEET #3

2. Cut 1/4" allthread rod to length (Figure 9)

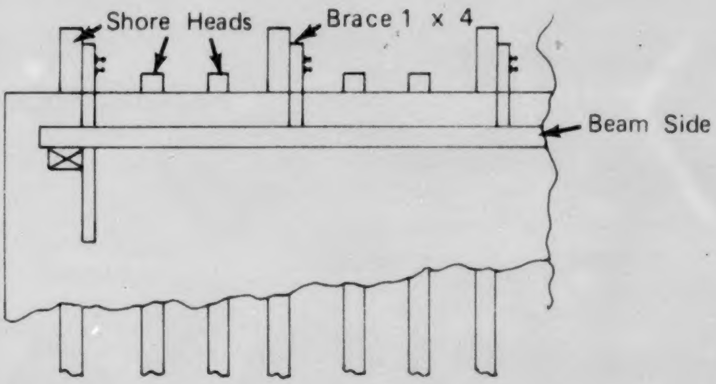
   (NOTE: The length of allthread needed is determined by the thickness of the slab, the deck, and the plate plus 1 1/2" for nuts and washers.)

FIGURE 9


Beam Side
3/4"
Plate Thickness
Washers If Form Is Heavy
Slab Thickness
Deck Thickness
3/4"

I. Build and install bulkheads at both ends of beam (Figure 10)

FIGURE 10


Shore Heads
Brace 1 x 4
Beam Side

J. Drill holes in bulkhead for post-tensioning anchors

   (NOTE: Form oil must be applied before installation of post-tensioning tendons and rebars. Location of the anchors will be shown on the plan or shop drawing.)

K. Install walers

   (NOTE: Make sure walers are centered on tie holes. Place form ties through form and waler and secure head.)

JOB SHEET #3

L. Erect inner beam side

1. Tack a temporary support to the stud on the inner beam side

   (NOTE: Leg should extend below the beam side a distance equal to the slab thickness plus 1/4".)

2. Rest the form on the supports and guide form ties through holes in beam side

   (NOTE: Nail a cleat across the top of the forms to hold it upright.)

3. Push form against spreader washers and drill holes for permanent supports

   (NOTE: Use a long bit so hole in plate and deck can be drilled at the same time.)

4. Install walers and secure tie heads

M. Install permanent beam supports

1. Screw nut on one end of allthread rod

2. Place washer on rod and insert in the hole of the plate

3. Hold conduit under the plate and insert rod through it and the deck

4. Screw nuts on rod under the deck

   (NOTE: These supports also serve to keep the form from floating when the concrete is poured.)

5. Remove temporary supports

   (NOTE: Post-tensioning is completed after the concrete has reached the designated strength. Beam bottom must be left in place until beam is post-tensioned.)

HORIZONTAL BEAM FORMS
UNIT VII

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. Terms and definitions are continued on the next page.

_____a. Piece of wood or other material that directs, resists, or supports weight or pressure

_____b. From tie with one end bent 90° and pointed

_____c. Piece of material nailed across a splice to strengthen and hold it together

_____d. Piece of wood that is used to hold the sides of the forms apart and is removed as the concrete is poured; may also be an integral part of a form tie

_____e. Strip of wood or metal fastened across a form for temporary positioning or to replace a form tie

_____f. Prop placed against or beneath an object for support

_____g. Horizontal timber placed across a shore and braced squarely

_____h. That part of the beam form which supports the vertical pressure

_____i. Piece of material used to resist horizontal pressure

_____j. Beam spanning between two structures to support the structure above

_____k. Piece of heavy material placed across several shores; horizontal or inclined supporting member

_____l. Single or multistrand of high tensile wire or a rod used to stress concrete

_____m. Process of introducing internal stresses after the concrete has reached a predetermined strength

1. Kicker
2. Shore head
3. Beam bottom
4. Spandrel beam
5. Cleat
6. Tendon
7. Scab
8. Shore
9. Nail point tie
10. Stringer
11. Brace
12. Spreader
13. Post-tensioning

______n. Horizontal timber laid directly on the ground to support a frame structure

______o. Paraffin oil or other manufactured product used on a form to prevent adhesion of concrete to the form

______p. Horizontal board used to hold shores in alignment and to resist lateral movement

______q. Tapered piece of wood or metal

______r. Stud frame and sheathing section which comprise the vertical section of a beam form

______s. Usually a large piece of wood, layed flat on the floor, on which the scaffolds or shores are set

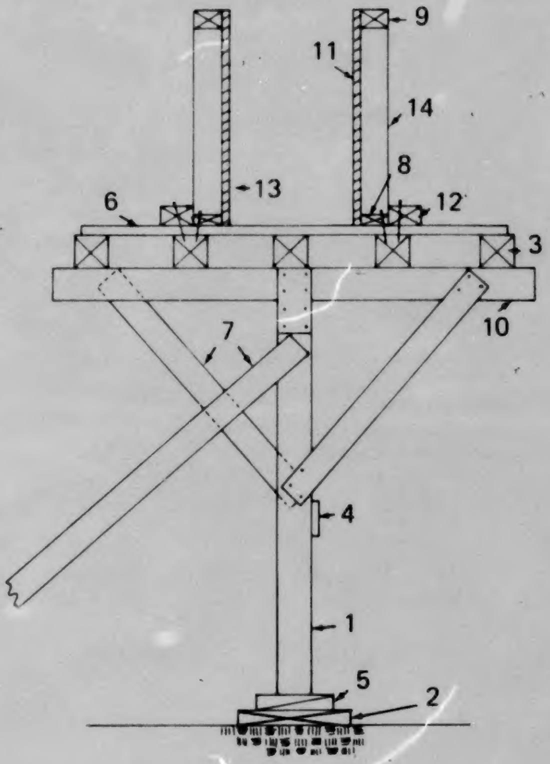
______t. Holes that are exposed in the concrete when the form snap ties are removed

______u. Horizontal brace used in form construction

______v. Tool used to jack up some patented shores

14. Mud sill
15. Beam side
16. Waler
17. Form oil
18. Wedge
19. Tie holes
20. Shore jack
21. Sill
22. Ribbon

2. Identify the parts of a beam form. Place the correct numbers in the blanks provided.



______a. Top plate

______b. Stud

______c. Sheathing

______d. Beam side

______e. Beam bottom

______f. Bottom plate

______g. Kicker

______h. Stringer

______i. Shore head

______j. Brace

______k. Ribbon

______l. Shore

______m. Wedge

______n. Mud sill

3. Name types of beams.

a. ______________________________

b. ______________________________

c. ______________________________

4. Name materials used to construct beam forms.

a. ______________________________

b. ______________________________

c. ______________________________

5. Name methods of shoring beams.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

6. Define *steel plate girder*.

____

____

7. Demonstrate the ability to:

   a. Construct a spandrel beam form.

   b. Construct an interior beam form.

   c. Construct an inverted beam form post-tensioned.

   (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

HORIZONTAL BEAM FORMS
UNIT VII

ANSWERS TO TEST

1. a. 11
   b. 9
   c. 7
   d. 12
   e. 5
   f. 8
   g. 2
   h. 3
   i. 1
   j. 4
   k. 10
   l. 6
   m. 13
   n. 14
   o. 17
   p. 22
   q. 18
   r. 15
   s. 21
   t. 19
   u. 16
   v. 20

2. a. 9
   b. 14
   c. 11
   d. 13
   e. 6
   f. 8
   g. 12
   h. 3
   i. 10
   j. 7
   k. 4
   l. 1
   m. 5
   n. 2

3. a. Spandrel
   b. Interior
   c. Inverted

4. a. Wood
   b. Metal
   c. Molded fiberglass

5. a. Wood T shore with wedges

   b. Wood T shore with manufactured clamps

   c. Patented shore

   d. Patented shore scaffold

6. Type of beam form that does not require intermediate shoring

7. Performance skills evaluated to the satisfaction of the instructor

CC - 387-G

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify parts of a slab forming system and the types of slabs. The student should be able to list the materials used to manufacture pans, domes, and void tubes and to name the types of manufactured exposed void forms. The student should also be able to construct and strip slab forms. This knowledge will be evidenced by completion of job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with above grade slab systems to the correct definitions.
2. Identify the parts of a slab forming system.
3. Identify types of slabs.
4. Name the types of slabs that can be post-tensioned.
5. List materials used to manufacture pans and domes.
6. List materials used to manufacture void tubes.
7. Name types of manufactured exposed void forms.
8. Define *flying form.*
9. Demonstrate the ability to:
    a. Construct forms for a two-way joist system.
    b. Construct forms for a one-way joist system.
    c. Construct and erect forms for a flying flat slab form.
    d. Strip a two-way joist form system (waffle).
    e. Set concealed void tubes.

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Parts of a Slab Forming System

      2. TM 2--One-Way Joist

      3. TM 3--Two-Way Joist (Waffle Slab)

      4. TM 4--Flat Slab

      5. TM 5--Steel or Molded Fiberglass Form

      6. TM 6--Molded Wood Fiber Form

      7. TM 7--Steel Dome Form

      8. TM 8--Adjustable and Flange Pans

      9. TM 9--Long Forms and Domes

      10. TM 10--Flying Form

D. Job sheets

1. Job Sheet #1--Construct Forms for a Two-Way Joist System
2. Job Sheet #2--Construct Forms for a One-Way Joist System
3. Job Sheet #3--Construct and Erect Forms for a Flying Flat Slab Form
4. Job Sheet #4--Strip a Two-Way Joist Form System (Waffle)
5. Job Sheet #5--Set Concealed Void Tubes

E. Test

F. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

B. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry.* 3rd ed. Chicago: American Technical Society, 1963.

C. Wagner, Willis H. *Modern Carpentry.* Homewood, Illinois: Goodheart-Willcox, 1969.

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

INFORMATION SHEET

I. Terms and definitions

   A. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure

   B. Scab--Piece of material nailed across a splice to strengthen and hold it together

   C. Shore--Prop placed against or beneath an object for support

   D. Kicker--Piece of material used to resist horizontal pressure

   E. Stringer--Piece of heavy material placed across several shores; horizontal or inclined supporting member

   F. Tendon--Single or multistrand of high tensile wire or a rod used to stress concrete

   G. Post-tensioning--Process of introducing internal stresses after concrete has reached a predetermined strength

   H. Form oil--Paraffin oil or other manufactured product applied to a form to prevent adhesion of concrete to the form

   I. Ribbon--Horizontal board used to hold shores in alignment and to restrict lateral movement

   J. Wedge--Tapered piece of wood or metal

   K. Pan--Single section of manufactured form used to mold exposed voids in a one-way joist system

   L. Void tube--Manufactured tube of metal or fiber used to create concealed voids in slabs

   M. Open centering--Framing for pans and domes comprised of joist soffit forms and headers

   N. Deck--Horizontal sheathing that supports the wet concrete

   O. Dome--Manufactured product which forms an exposed void in a waffle slab system

   P. Waffle--Design of a slab which is poured on domes; two-way joist system

   Q. Flying forms--System whereby a large section of slab forms is removed with a crane and moved to the next pour location

   R. Mud sill--Horizontal timber laid directly on the ground or floor to support a frame structure

INFORMATION SHEET

II. Parts of a slab forming system (Transparency 1)

   A. Shore

   B. Joist soffit form

   C. Header

   D. Deck

   E. Stringer

   F. Dome

   G. Pan

   H. Wedge

   I. End cap or enclosure

III. Types of slabs (Transparencies 2, 3, and 4)

   A. One-way joist

   B. Two-way joist (waffle)

   C. Flat slab

IV. Types of slabs that can be post-tensioned--All types of slabs can be post-tensioned

V. Materials used to manufacture pans and domes (Transparencies 5, 6, and 7)

   A. Molded fiberglass

   B. Steel

   C. Molded fiber (wood or paper)

VI. Materials used to manufacture void tubes

   A. Steel

   B. Fiber (paper)

VII. Types of manufactured exposed void forms (Transparencies 8 and 9)

   A. Adjustable form

   B. Flange form

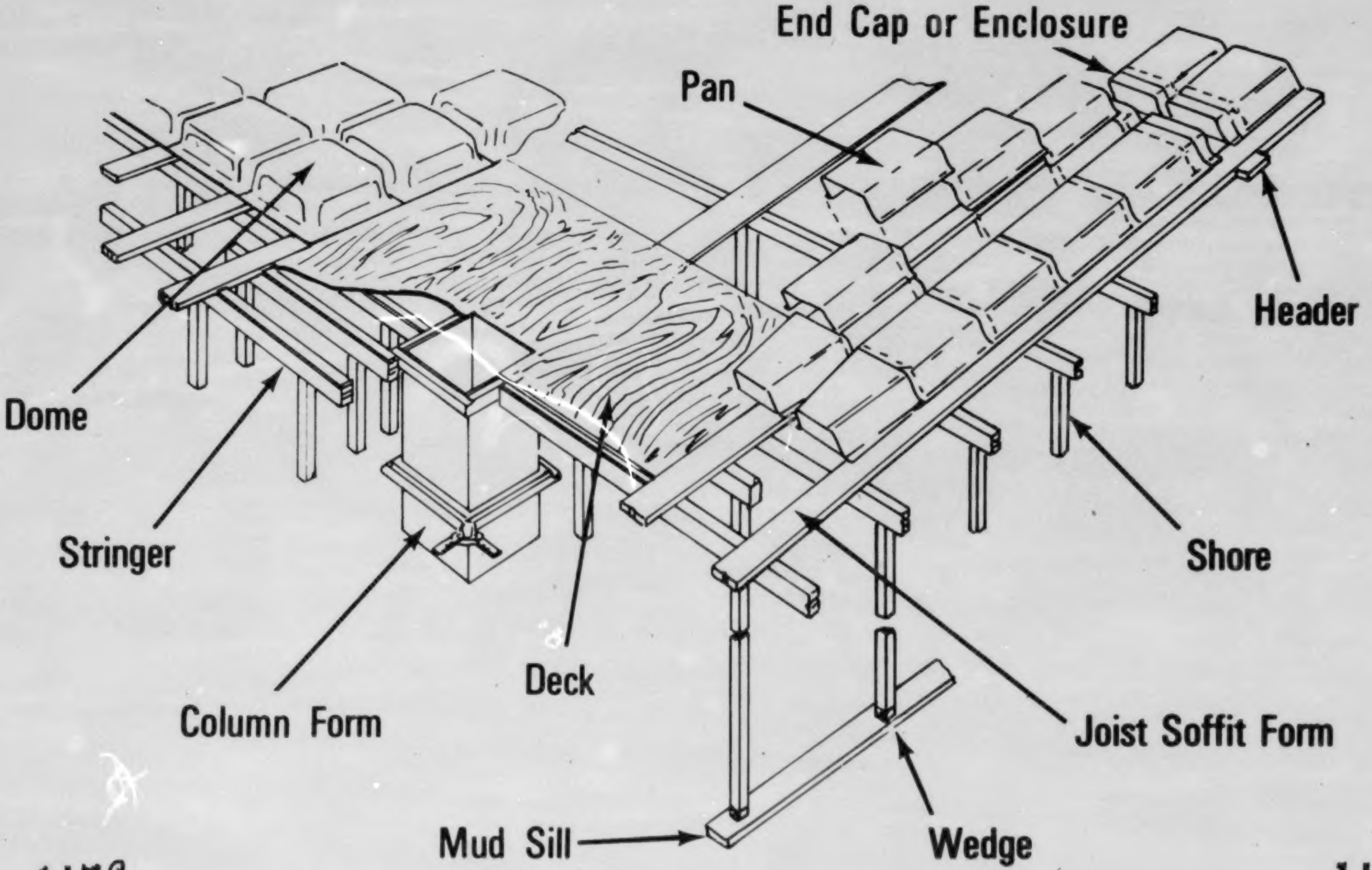
   C. Long form

   D. Dome form

INFORMATION SHEET

VIII. Flying form--Slab forming system whereby large sections of forms are moved intact to another pour location by means of a crane or other lifting device (Transparency 10)

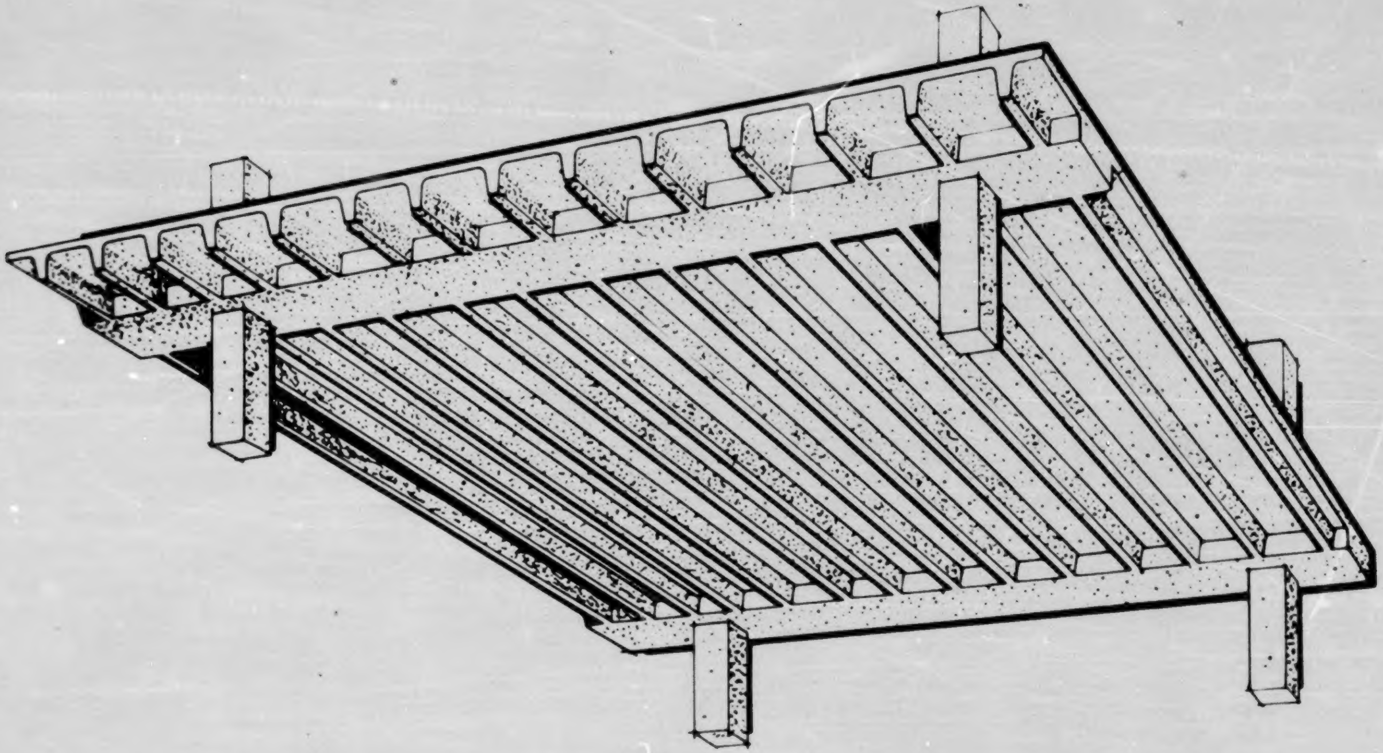
Parts of a Slab Forming System


End Cap or Enclosure
Pan
Header
Dome
Stringer
Shore
Column Form
Deck
Joist Soffit Form
Mud Sill
Wedge

1179

1180

One-Way Joist

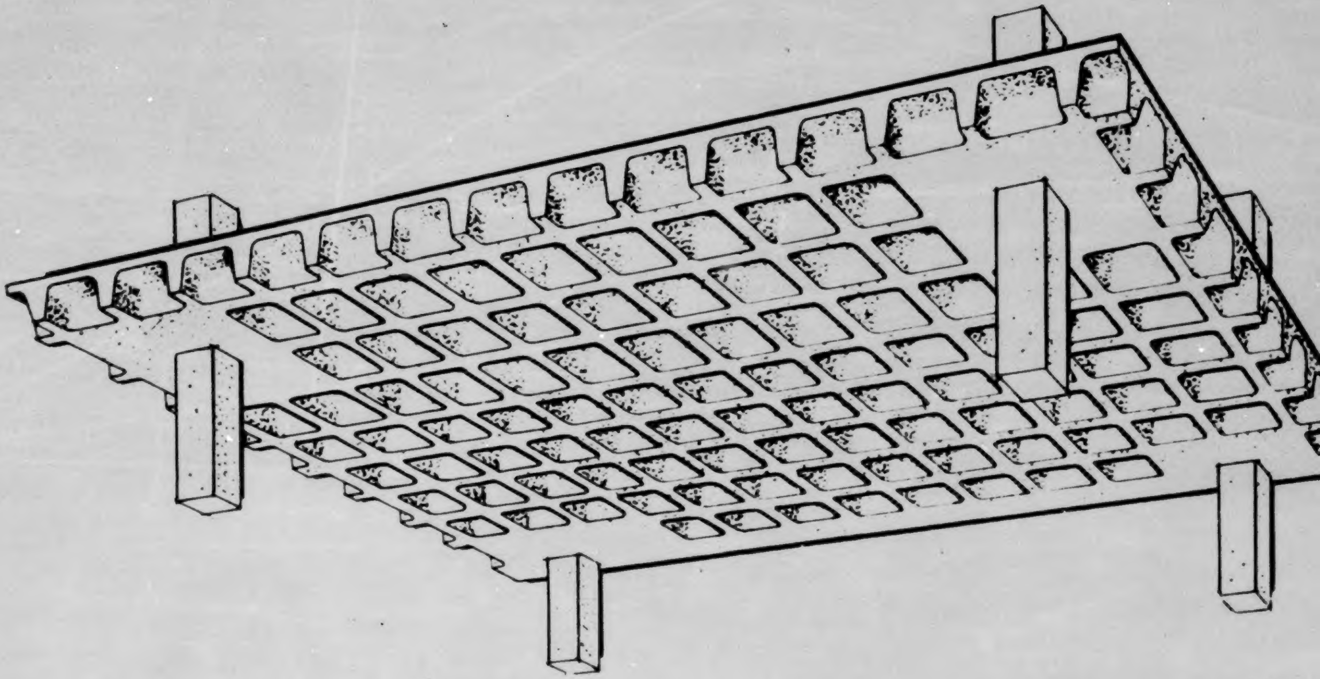


1181

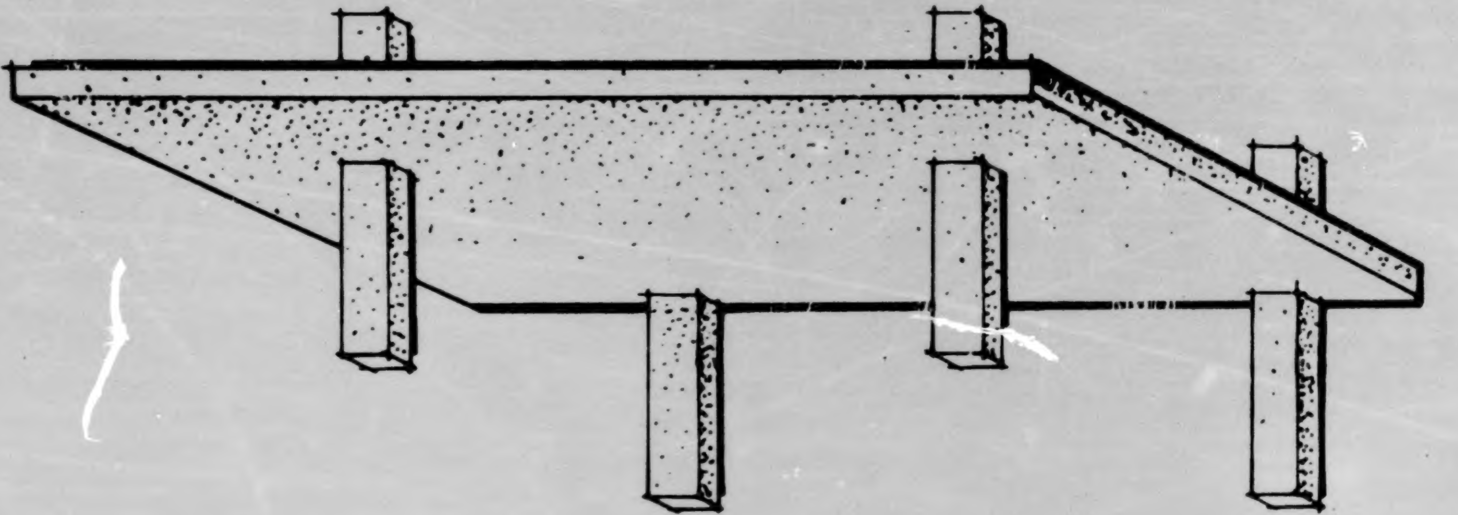
1182

Two-Way Joist

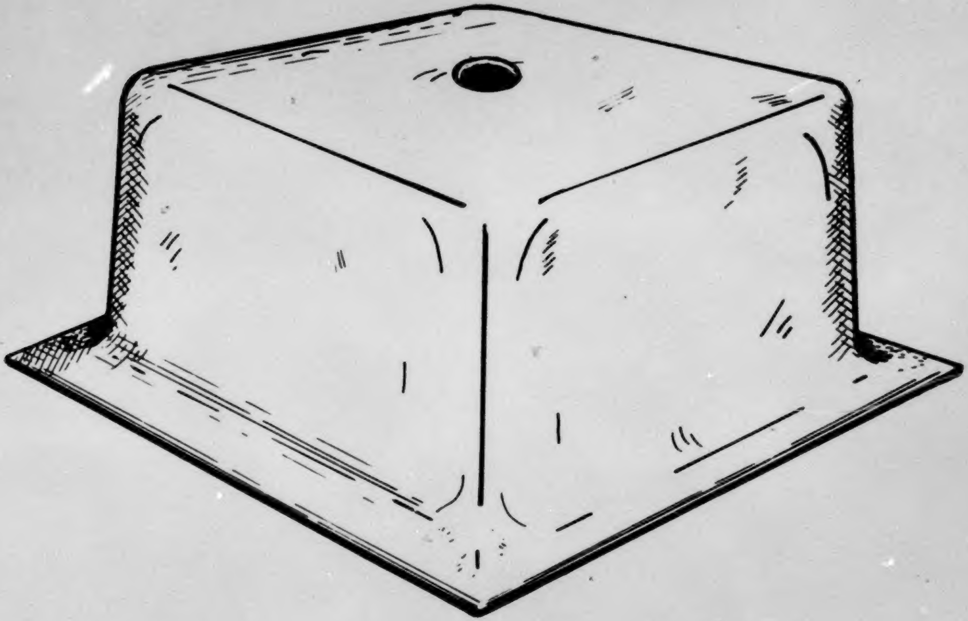
(Waffle Slab)



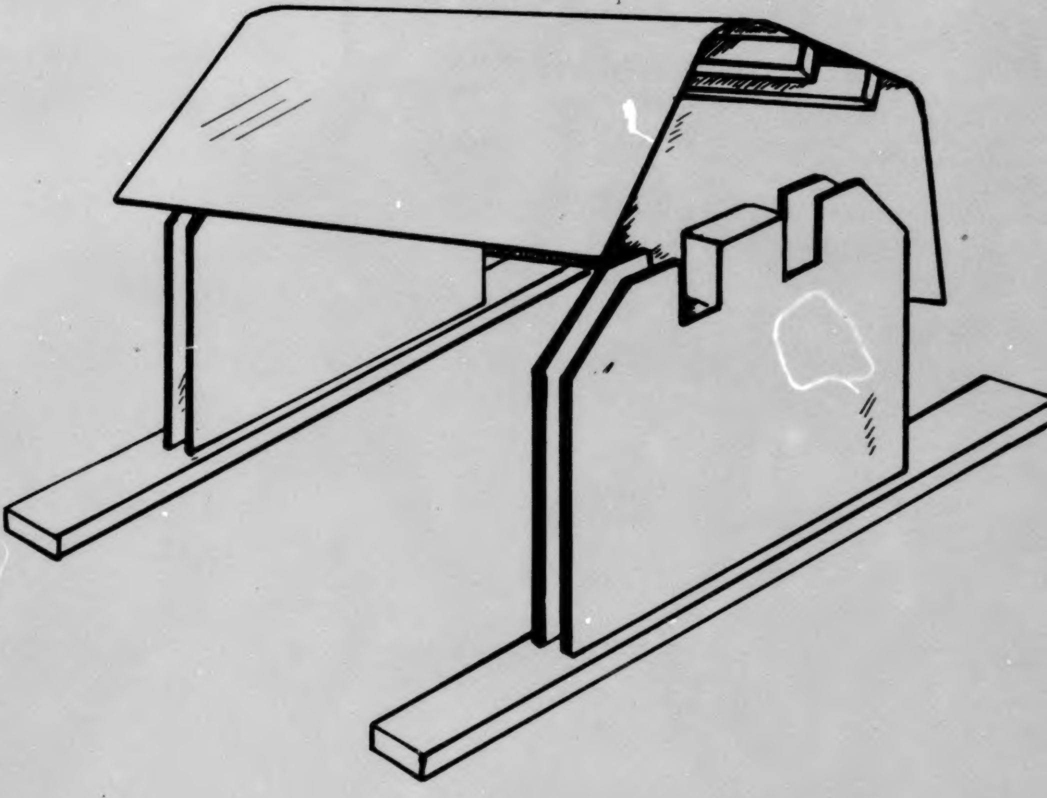
Flat Slab



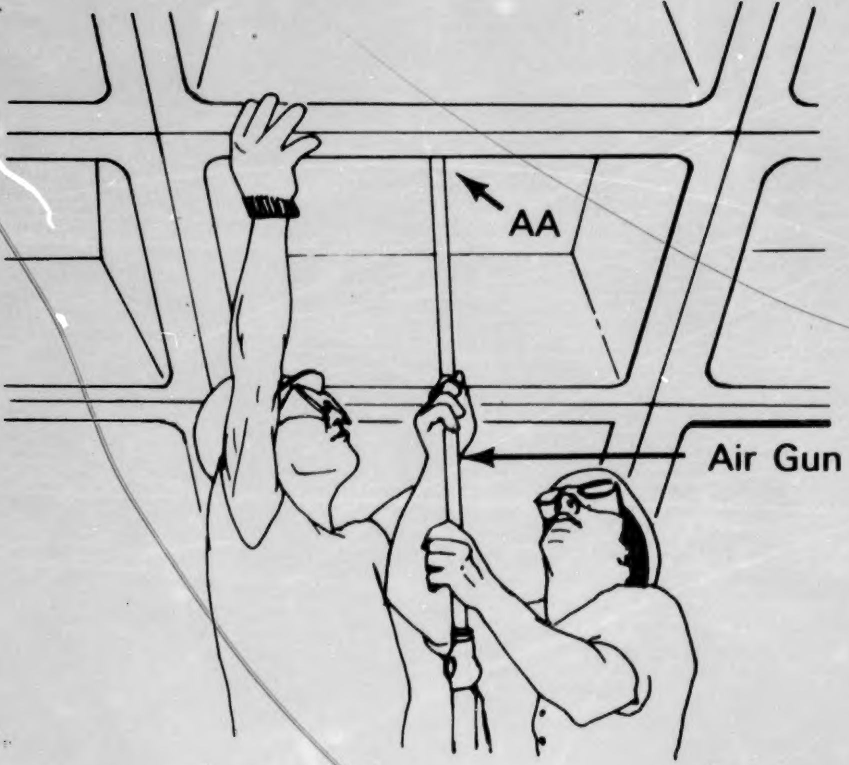
Steel or Molded Fiberglass Form

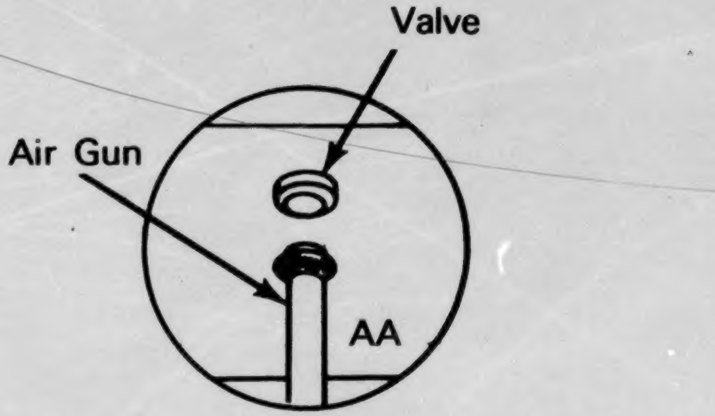


Molded Wood Fiber Form



Steel Dome Form

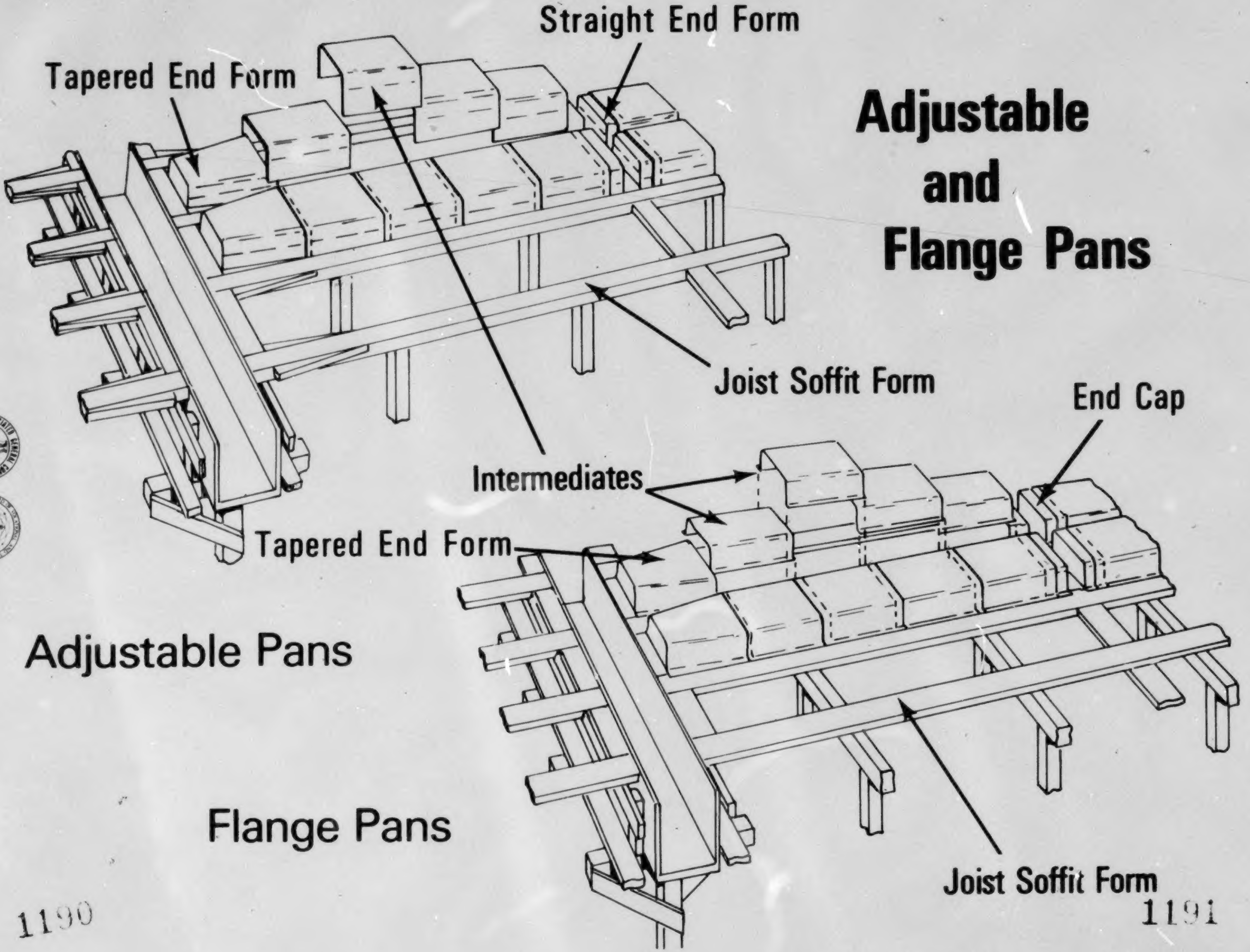



Valve
Air Gun
AA

Air Valve

COURTESY OF CECO STEEL PRODUCTS CORPORATION

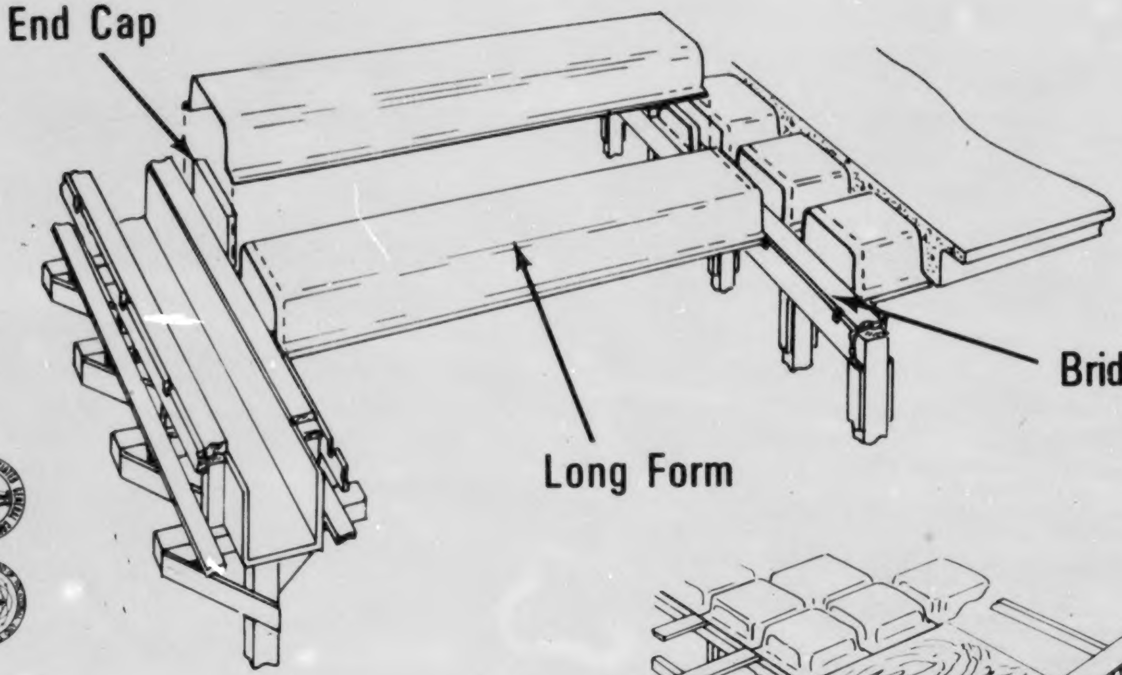
Adjustable and Flange Pans


Straight End Form
Tapered End Form
Joist Soffit Form
End Cap
Intermediates
Tapered End Form
Joist Soffit Form

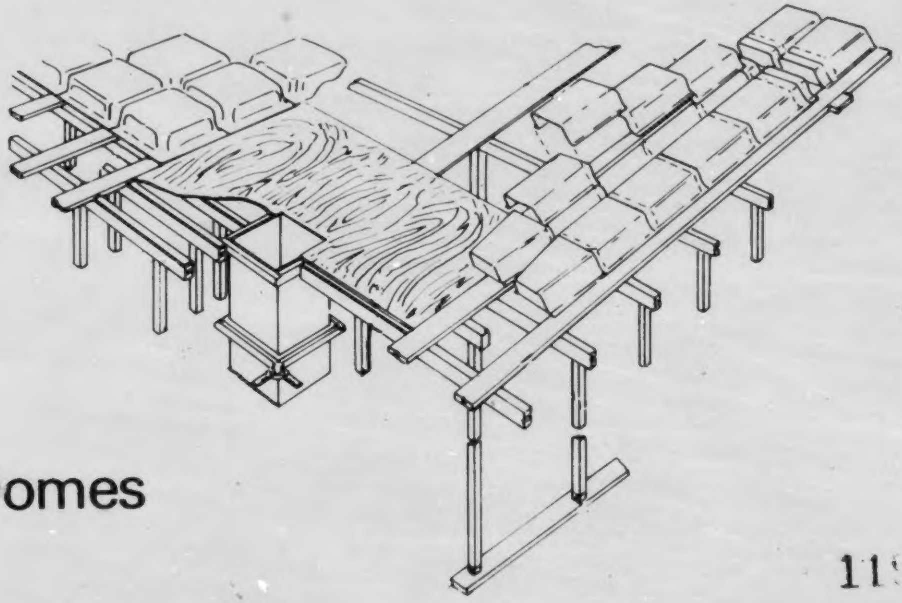
Adjustable Pans

Flange Pans

Long Forms and Domes


End Cap
Long Form
Bridging Joist Soffit Form

Long Forms

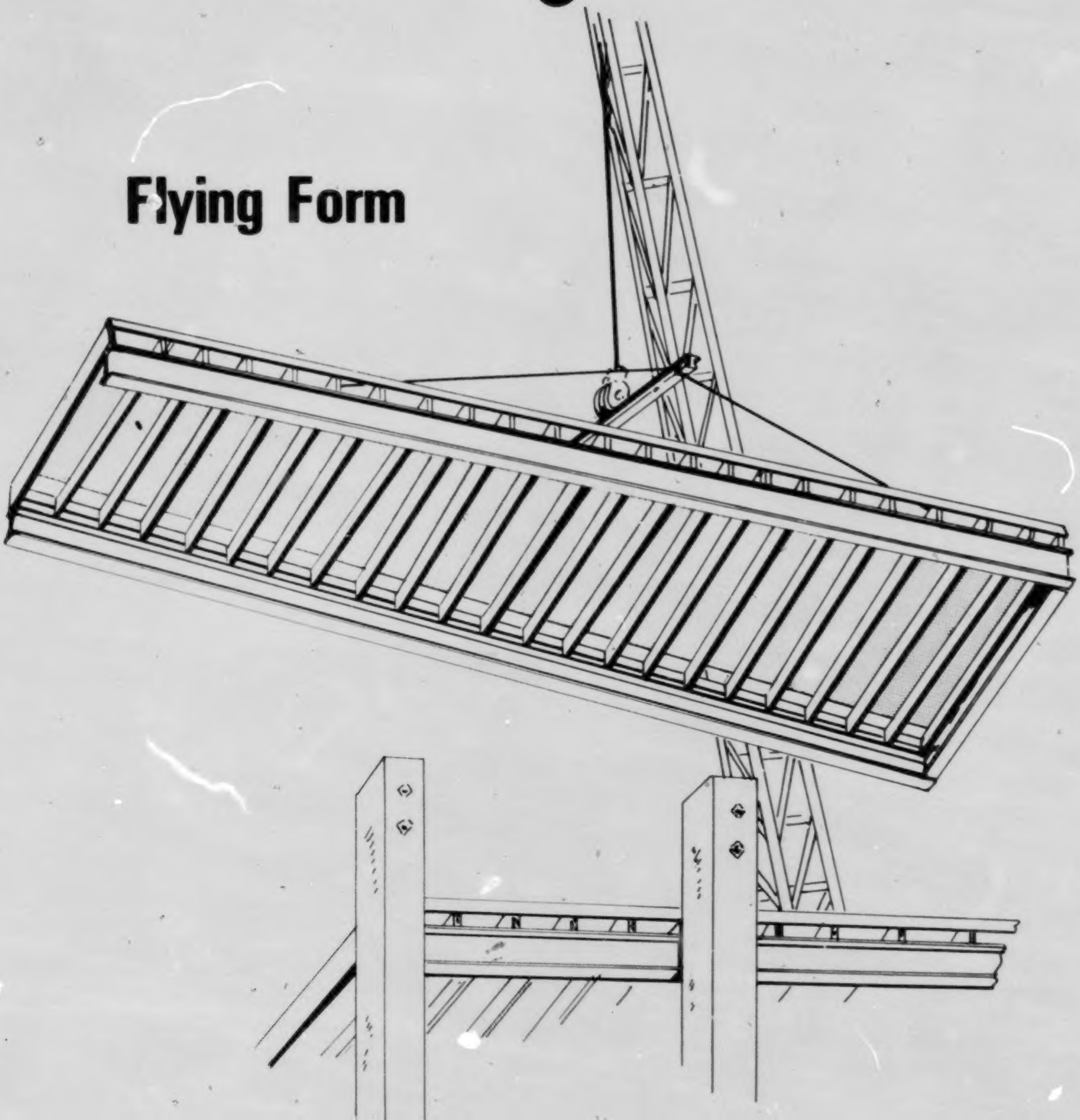


Domes

11?2

1193

Flying Form



ABOVE GRADE SLAB SYSTEMS
UNIT VIII

JOB SHEET #1--CONSTRUCT FORMS FOR A TWO-WAY JOIST SYSTEM

(NOTE: The shoring system used in this job sheet may be used on any type of slab. A solid plywood decking may also be installed.)

I. Tools and materials

  A. Tools

    1. Claw hammer, 16 oz or larger
    2. Handsaw, crosscut
    3. Electric handsaw
    4. Level, hand, 30"
    5. Chalk line
    6. Builder's level
    7. String line
    8. Transit level
    9. Sawhorses

  B. Materials

    1. 2 x 8's or larger for sills
    2. Shore frames (scaffold)
    3. Dome forms
    4. 2 x 8's or 2 x 10's for joist soffit form
    5. Plywood deck
    6. Horizontal shores
    7. Dome nails

       (NOTE: Check manufacturer's specifications.)

    8. 4 x 6's for stringers
    9. Form oil
    10. Screw jacks

JOB SHEET #1

11. Nails

    a. 6d duplex

    b. 16d duplex

II. Procedure

A. Erect shore frames

1. Lay sill pieces on deck

   (NOTE: Sill locations should be one-half the frame width each side of the column center line.)

2. Set adjustable screw legs in approximate final location

   (NOTE: Final location is one foot from column face.)

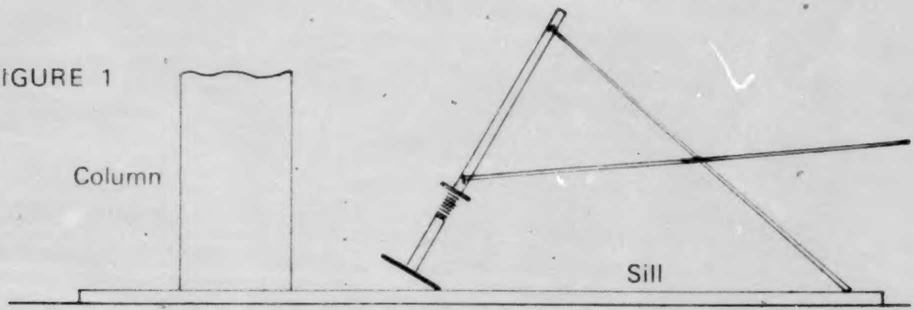
3. Attach screw legs to scaffold

   (NOTE: Screw legs must have base plates.)

4. Stand frame upright and attach two **X** braces (Figure 1)

   (NOTE: Lean top of frame and secure top brace first.)

FIGURE 1



5. Attach second frame by raising brace until it aligns with stud on frame

   (NOTE: If wing nuts are used to attach braces, catch only enough threads to hold the nut on as they will have to be removed to attach the next brace.)

6. Attach braces to the frame set last

7. Attach next frame to braces

8. Repeat steps 6 and 7 to continue erection

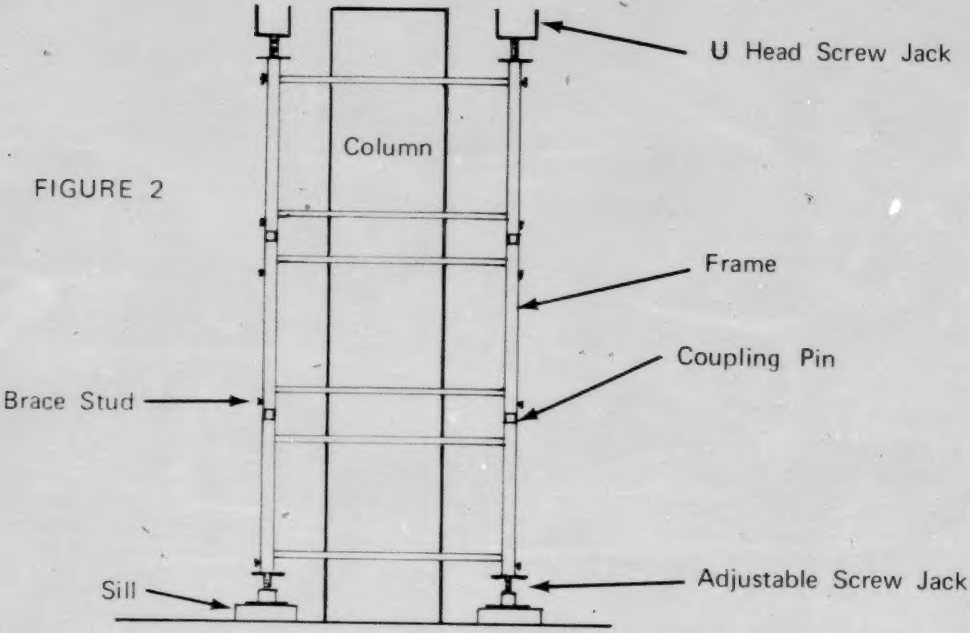
JOB SHEET #1

9. Place coupling pins in top of frame legs

   (NOTE: Some patented scaffolds have a small bottom end which slips inside the lower frame; therefore, coupling pins are not used.)

10. Place scaffold plank on top of frames
11. Set frame for second row on pins
12. Attach braces
13. Set second frame and secure braces
14. Repeat steps 9 though 13 to continue erection
15. Install U head screw jacks on all frame posts (Figure 2)

FIGURE 2


U Head Screw Jack
Column
Frame
Coupling Pin
Brace Stud
Sill
Adjustable Screw Jack

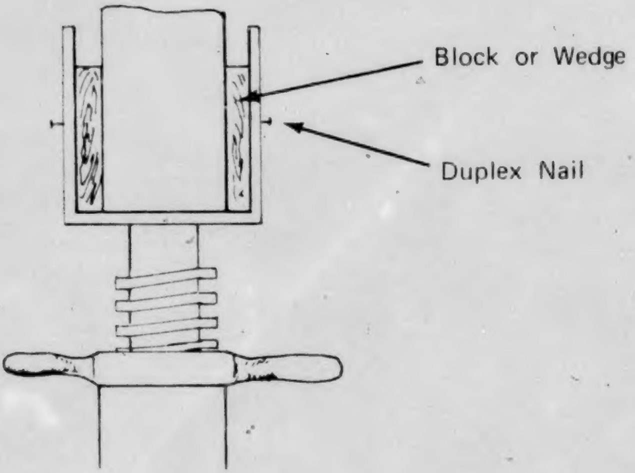
JOB SHEET #1

B. Install stringers

1. Lay stringers in U head (Figure 3)

   (NOTE: If stringers are not as wide as the U head, block both sides so stringer is centered.)

FIGURE 3



2. Nail stringers to U head

   (NOTE: U heads are predrilled. Use duplex nails.)

C. Set up shore scaffold on next column line as outlined in A and B

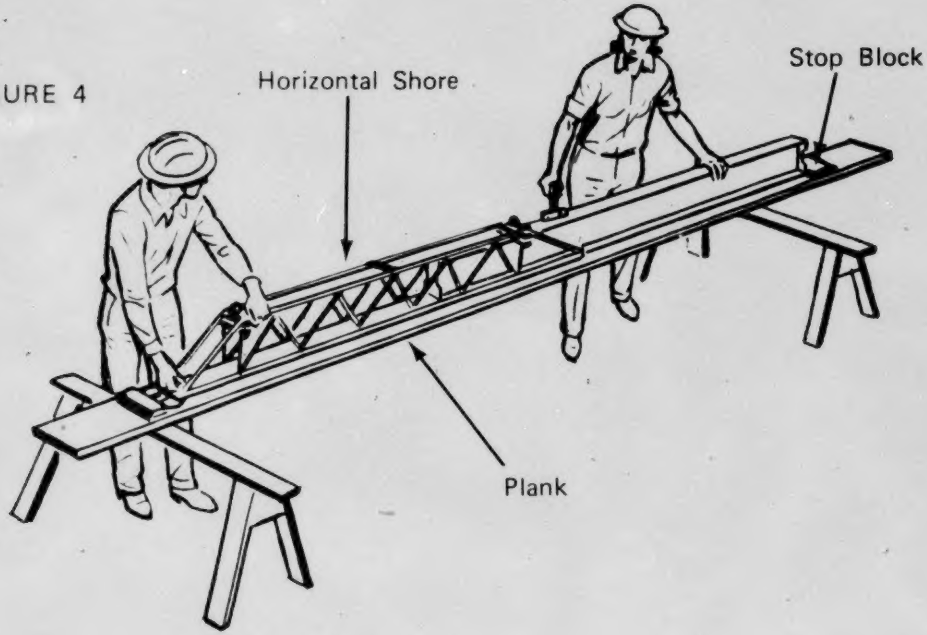
JOB SHEET #1

D. Install horizontal shores

1. Make jig for adjusting shores (Figure 4)

   (NOTE: A light template with blocks nailed on each end may also be used to adjust the shores.)

FIGURE 4



2. Adjust horizontal shores to proper length and lock tightly

3. Lay out center line of structural joist on the stringer

   (NOTE: Determine joist spacing from structural plans.)

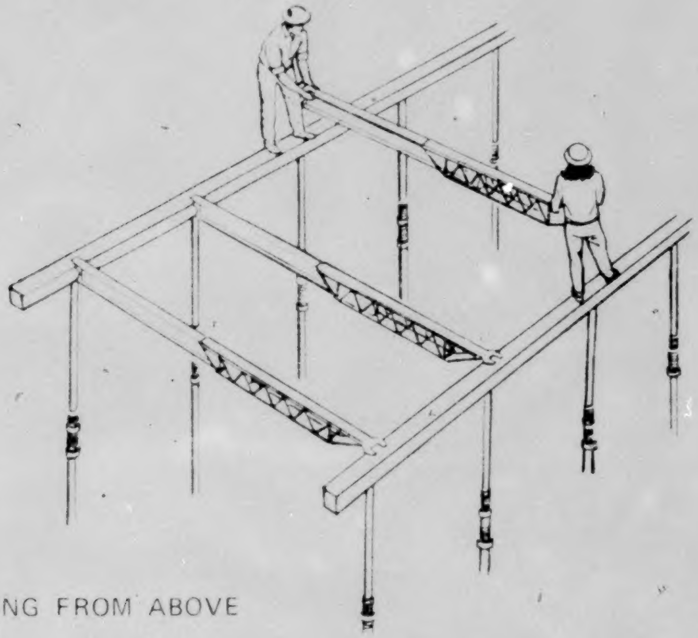
JOB SHEET #1

4. Set horizontal shores (Figures 5a and 5b)

(NOTE: Center shore on layout mark. Shores can be set from above or below.)

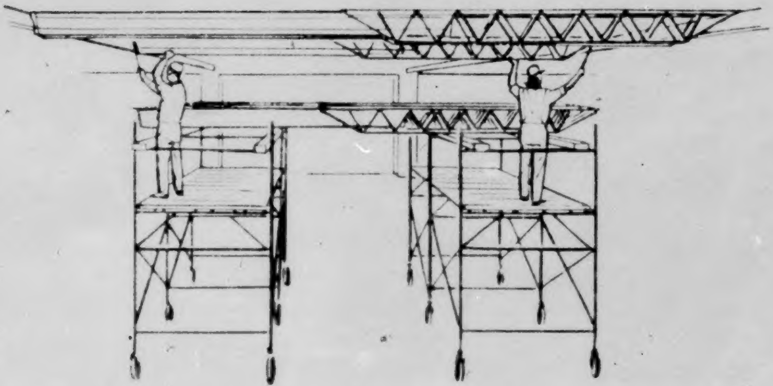
(CAUTION: Workers are required to wear safety belts and take all necessary safety precautions.)

FIGURE 5a



SETTING FROM ABOVE

FIGURE 5b



ROLLING TOWER METHOD

JOB SHEET #1

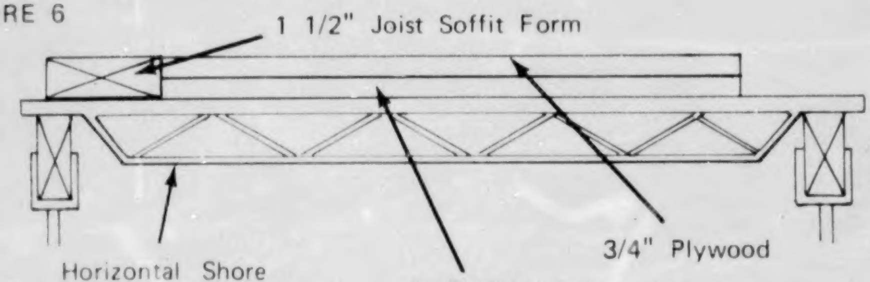
E. Install beam soffit

1. Lay one-inch thick material on top of horizontal shores

2. Nail plywood to one-inch strips (Figure 6)

   (NOTE: Horizontal shores might have to be set closer together in the beam area. Let plywood extend past side of beam to support one flange of the dome.)

FIGURE 6


1 1/2" Joist Soffit Form
3/4" Plywood
Horizontal Shore
3/4" Thick Filler

F. Install domes

1. Snap chalk line on deck at sides of beam

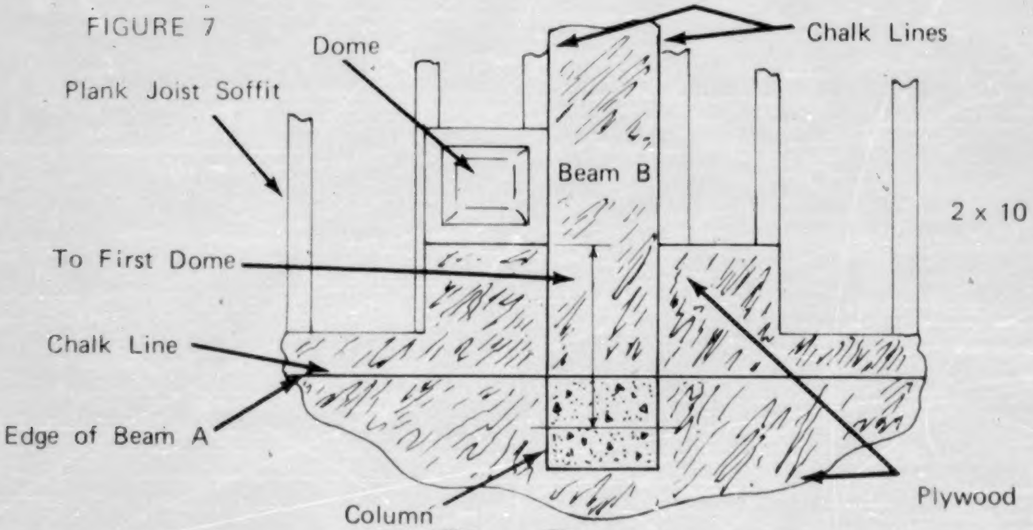
2. Lay plank across horizontal shores at joist center lines

3. Measure from column center line to edge of first dome and place pencil mark at this point

4. Set first dome (Figure 7)

   (NOTE: Align dome flange with chalk line on one edge and place pencil mark at adjoining edge.)

FIGURE 7


Dome
Chalk Lines
Plank Joist Soffit
Beam B
2 x 10
To First Dome
Chalk Line
Edge of Beam A
Column
Plywood

JOB SHEET #1

5. Set second dome on chalk line and against first pan; nail to plywood and joist bottom form

   (NOTE: Check manufacturer's specifications for nailing and header instructions.)

6. Repeat step number 5 to set all domes in this row

7. Set second row of domes against the flange and in line with flange joints of first row

   (NOTE: An additional dome might be added to this line to bring it to the side of beam A in Figure 7.)

8. Repeat step number 7 to continue setting remaining rows of domes

9. Coat entire form surface with form oil

   (NOTE: Form oil must be applied before rebars are installed.)

G. Install perimeter beam side

1. Build spandrel beam side

   (NOTE: The height of the beam side will be equal to the height of the dome plus the thickness of the slab.)

2. Coat form surface with form oil

3. Snap a chalk line on the plywood at the outside of the beam

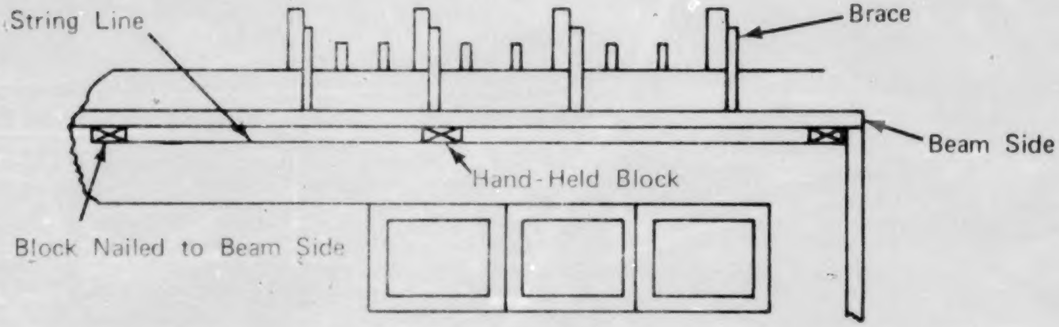
4. Nail beam side kicker to deck

5. Stand beam side on deck and nail to kicker

6. Brace beam side (Figure 8)

   (NOTE: Stretch string line over blocks to align top of form.)

FIGURE 8



JOB SHEET #1

H. Check elevation of deck

1. Set up instrument on floor below
2. Establish HI of instrument
3. Make story pole correspond with elevation of bottom of beam bottom plywood
4. Adjust upper or lower screw legs to obtain correct elevation at beams (Figure 9)

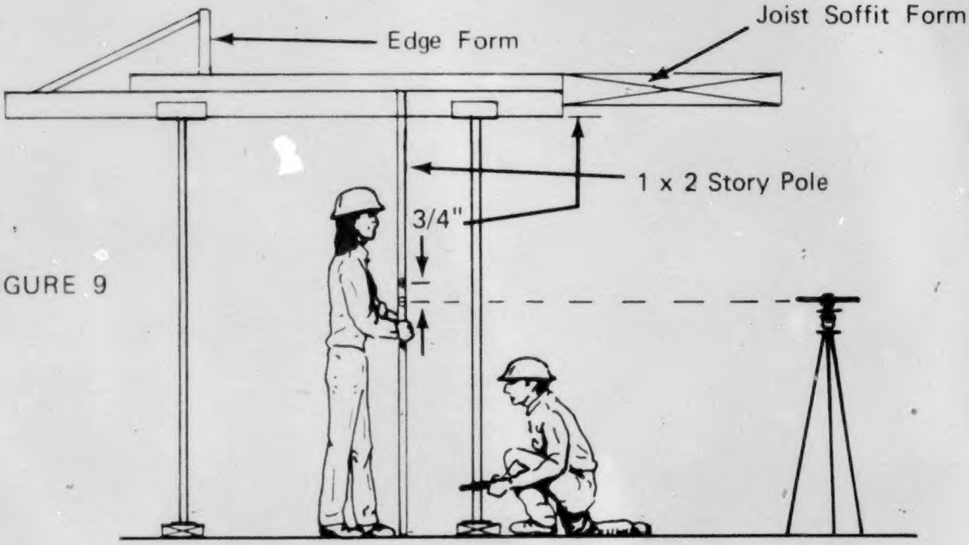


FIGURE 9

5. Check intermediate towers

   (NOTE: Place mark 3/4" above deck mark to check joist form.)

I. Install bulkhead

(NOTE: If entire floor can not be poured at one time, bulkhead must be installed. If location is not given in the plans or specifications, check with your superior for permissible location.)

1. Place a 2 x 4 under the wire mesh on the end of pour
2. Screw 2 x 4 to pans

   (NOTE: Check dome supplier for permissible anchorage.)

3. Lay 2 x 4 on top of mesh and first 2 x 4

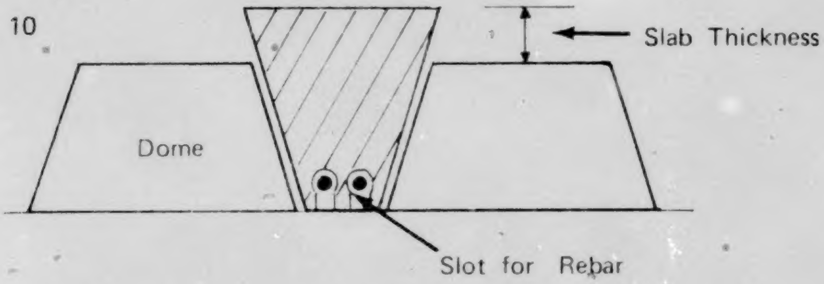
JOB SHEET #1

4. Wedge upper 2 x 4 to proper elevation

5. Cut tapered pieces of plywood for joist area (Figure 10)

   (NOTE: Make one piece and use it for a pattern.)

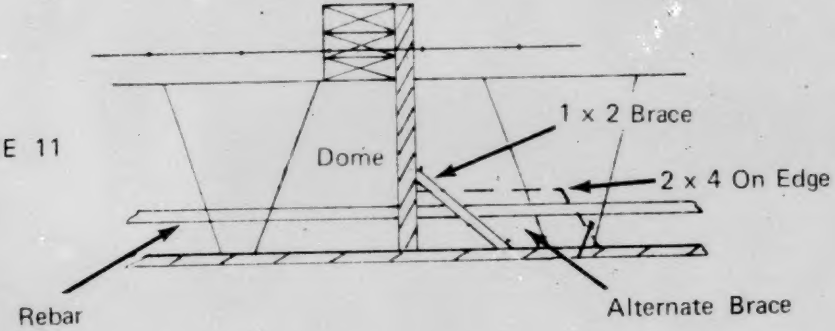
FIGURE 10


Slab Thickness
Dome
Slot for Rebar

6. Nail plywood pieces to upper 2 x 4's

7. Brace bottom of plywood bulkhead (Figure 11)

FIGURE 11


1 x 2 Brace
Dome
2 x 4 On Edge
Rebar
Alternate Brace

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

JOB SHEET #2--CONSTRUCT FORMS FOR A ONE-WAY JOIST SYSTEM

I. Tools and materials

A. Tools

1. Claw hammer, 16 oz or larger
2. Handsaw, crosscut
3. Electric handsaw
4. Level, hand, 30"
5. Chalk line

B. Materials

1. 2 x 8's or larger for sills
2. Patented shores
3. [illegible]ng forms
4. 2 x 6's or 2 x 8's for joist soffit form
5. Plywood deck
6. 2 x 10's for joist
7. 4 x 6's for shore head
8. Form oil
9. Nails
    a. 6d duplex
    b. 16d duplex
    c. 6d common

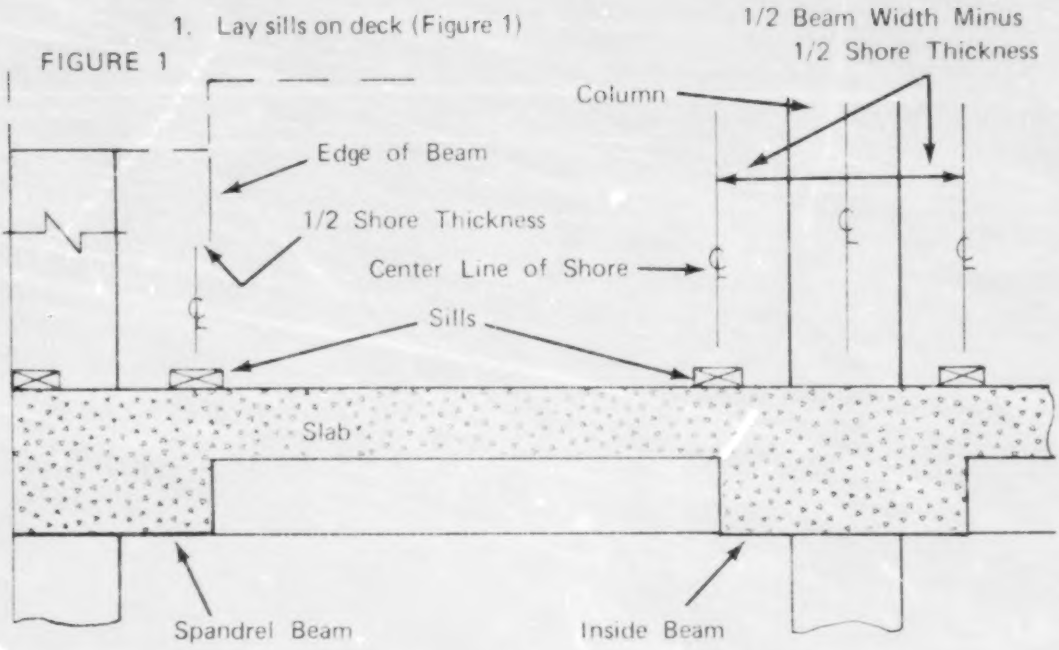
JOB SHEET #2

II. Procedure

A. Erect shores and joist

1. Lay sills on deck (Figure 1)

FIGURE 1


1/2 Beam Width Minus
1/2 Shore Thickness
Column
Edge of Beam
1/2 Shore Thickness
Center Line of Shore
℄
Sills
Slab
Spandrel Beam
Inside Beam

2. Secure two shores to shore head (Figures 2a and 2b)

(NOTE: Shore center lines should correspond with sill center line.)

FIGURE 2a

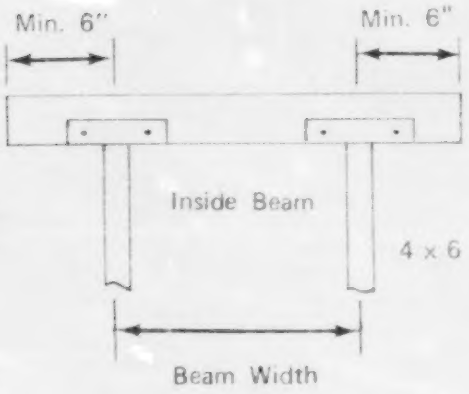
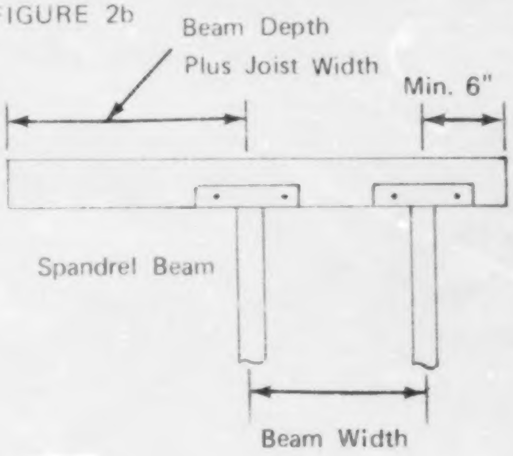

Min. 6"
Min. 6"
Inside Beam
4 x 6
Beam Width

FIGURE 2b


Beam Depth
Plus Joist Width
Min. 6"
Spandrel Beam
Beam Width

JOB SHEET #2

3. Stand first shore unit upright and brace it plumb in both directions

   (NOTE: Set first unit one foot from the column. Nail base plates to the sill.)

4. Stand second unit upright at the end of the joist and brace it plumb in both directions

5. Nail center joist to shore heads

6. Snap a chalk line on shore heads at both sides of the beam

7. Nail remaining joists to shore heads

   (NOTE: Nail edge joist accurately on the inside of the chalk line.)

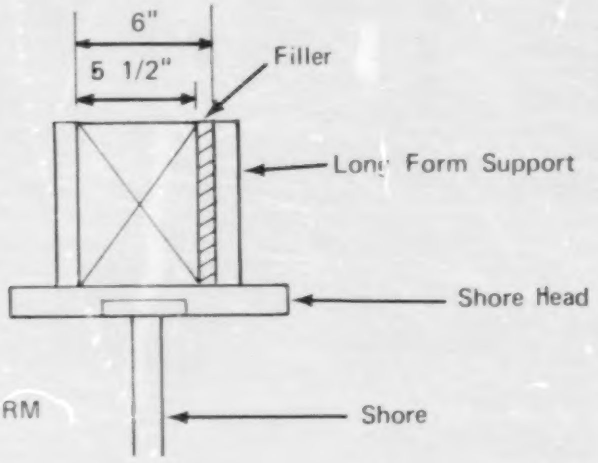
8. Install bridging joist bottom forms

   (NOTE: Bridging joists are placed at the end of long forms which are not adjacent to beams.)

   a. Frame stringers to exact width of bridging joist (Figure 3)

      (NOTE: Stringer may be ripped or a filler added to attain correct width. It may also be laminated.)

FIGURE 3



BRIDGING JOIST FORM

   b. Secure short shore heads to single shore (Figure 3)

   c. Stand T shores on sill and brace plumb in both directions

      (NOTE: Shores will be placed to support each end of the stringer.)

JOB SHEET #2

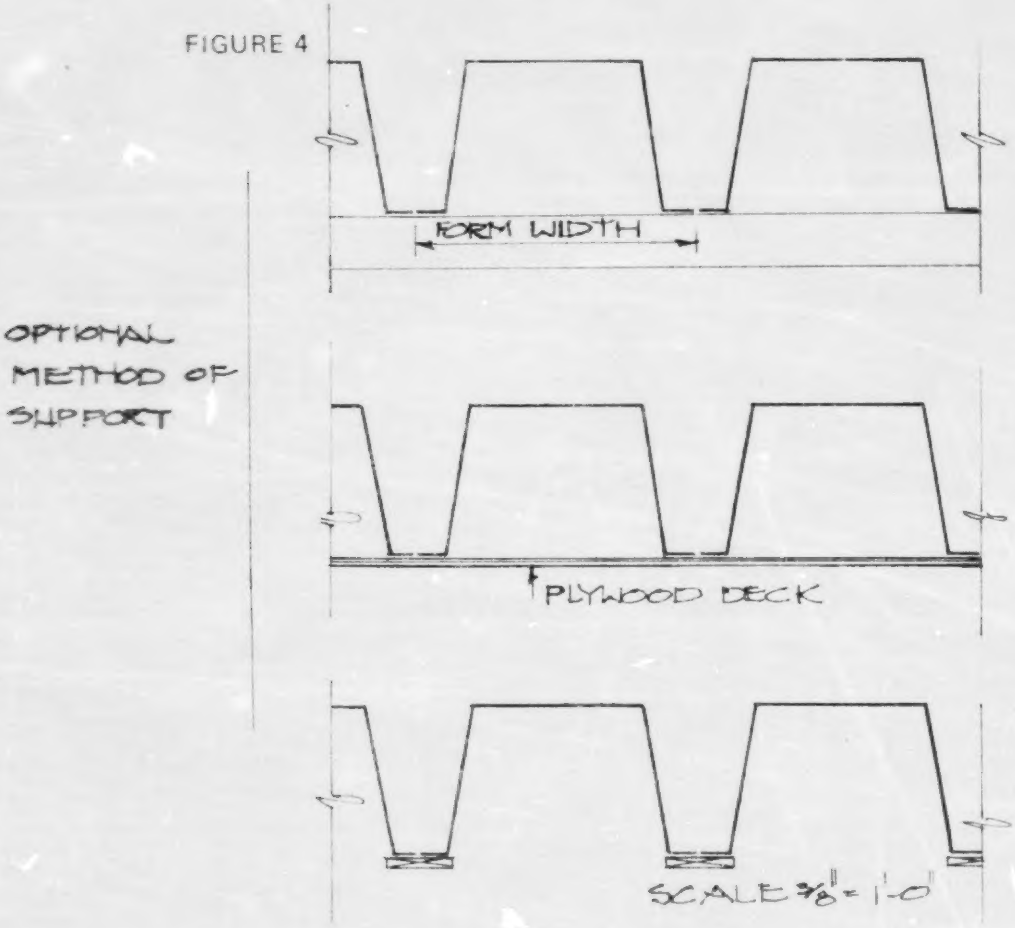
d. Nail stringer to shore heads

e. Install intermediate shores

f. Repeat steps a through e to continue erection of all bridging joist bottoms

B. Install all long form supports and the ones at the bridging joist (Figure 4); nail long form support to stringer

FIGURE 4


FORM WIDTH
OPTIONAL
METHOD OF
SUPPORT
PLYWOOD DECK
SCALE 3/8" = 1'-0"

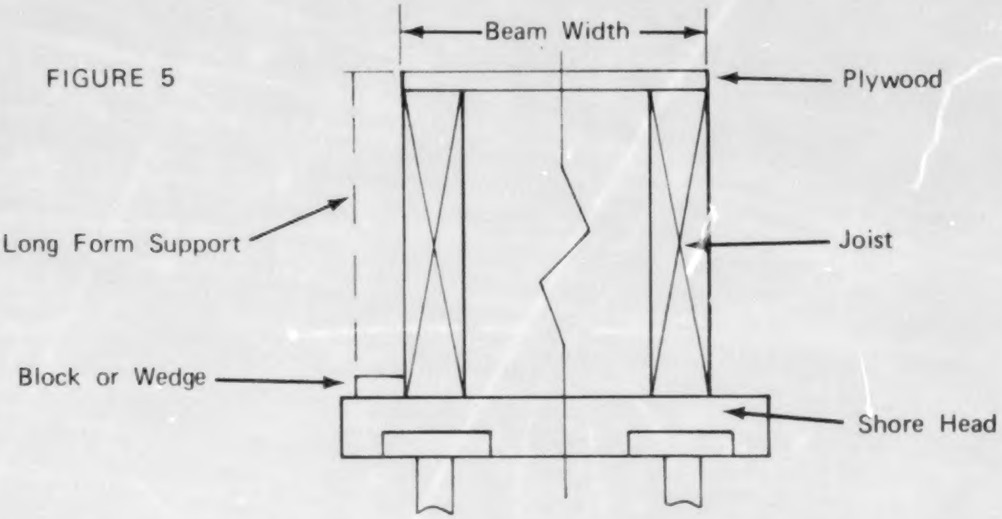
(NOTE: Material should be the same width as the stringer. See Figure 3. Clamps recommended and furnished by manufacturer should be used.)

JOB SHEET #2

C. Install beam soffit form material and long form supports

1. Fabricate plywood to exact width of beam (Figure 5)

FIGURE 5


Beam Width
Plywood
Long Form Support
Joist
Block or Wedge
Shore Head

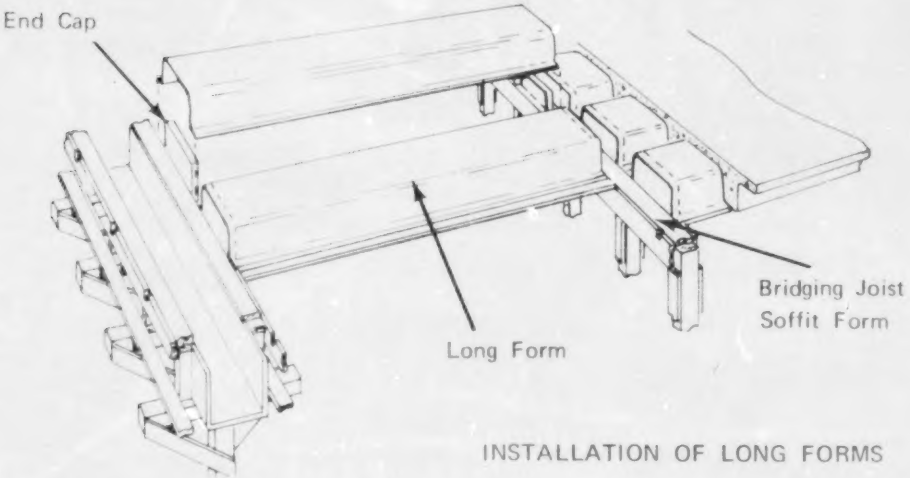
2. Nail plywood to joist

3. Nail long form supports to joist

(NOTE: If necessary, block long form support as shown in Figure 5 to bring top flush with plywood.)

D. Install long forms (Figure 6)

FIGURE 6


End Cap
Bridging Joist
Soffit Form
Long Form

INSTALLATION OF LONG FORMS

JOB SHEET #2

1. Nail end caps to supports
2. Set long form over end cap
3. Nail flange to form support

   (NOTE: Follow manufacturer's installation instructions.)

4. Repeat steps 1, 2, and 3 to continue setting remainder of long forms

E. Apply form oil to all surfaces exposed to concrete

(NOTE: Rebar shall be installed after form oil has been applied.)

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

JOB SHEET #3--CONSTRUCT AND ERECT FORMS FOR A FLYING FLAT SLAB FORM

(NOTE: Concealed void slab forms are constructed very similarly. Any type of shoring may be used.)

I. Tools and materials

  A. Tools

    1. Claw hammer, 16 oz or larger
    2. Handsaw, crosscut
    3. Electric handsaw
    4. Chalk line
    5. Builder's transit
    6. Two steel tapes, 16'

  B. Materials

    1. Plywood deck
    2. Horizontal shores
    3. Shores, patented type that attach to columns
    4. I beam ledgers
    5. 4 x 6's for joist
    6. Form oil
    7. Nails

II. Procedure

  A. Build form section

    1. Determine exact width of form section

      (NOTE: Form section might be slightly smaller than distance between columns. Follow shore manufacturer's recommendations.)

JOB SHEET #3

2. Lay I beam ledgers on a level base

   (NOTE: I beams will be parallel to each other.)

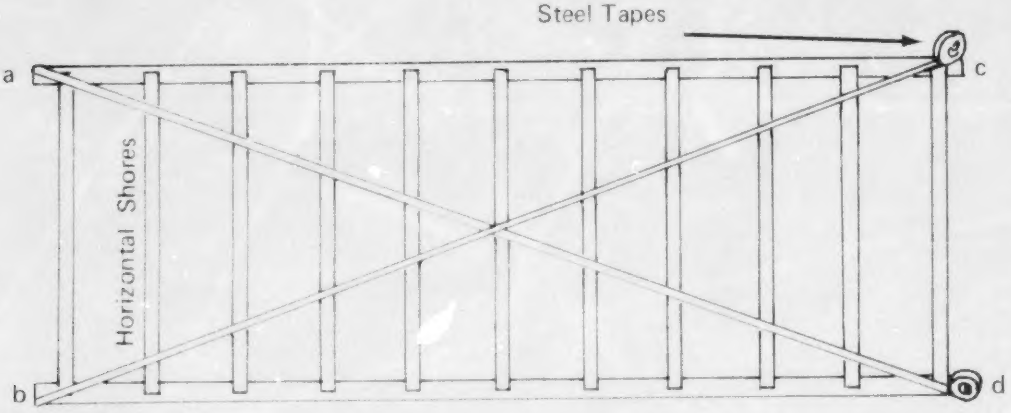
3. Lay horizontal shores on I beam ledgers and secure to ledgers

   (NOTE: Use manufactured clips or bolts as recommended.)

4. Square unit using the diagonal method (Figure 1)

   (NOTE: X bracing might be added to hold unit square and for rigidity.)

FIGURE 1



(NOTE: I beam ledgers a-c and b-d must be parallel. Hook tape at point a and read at point d. Repeat process at points b and c. The two readings should be the same If not, slide either ledger to correct reading. See Figure 1.)

5. Secure joist to horizontal shores

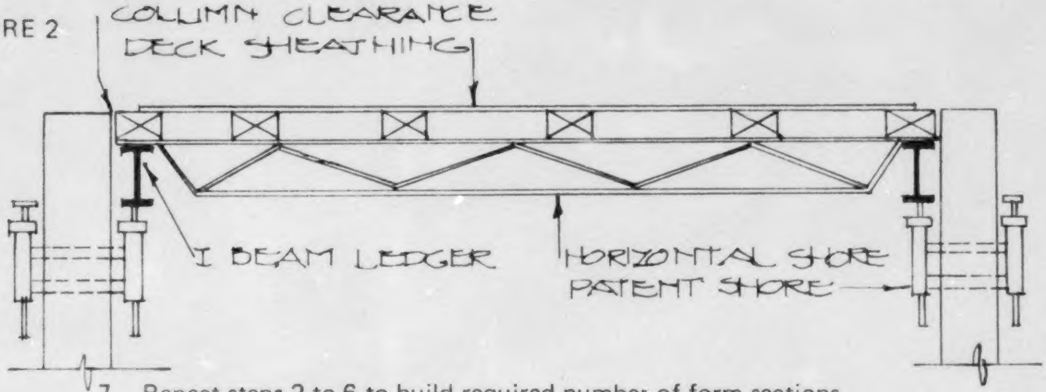
   (NOTE: Use manufactured clips or bolts. Check manufacturer's recommendations.)

JOB SHEET #3

6. Nail decking to joist (Figure 2)

(NOTE: Plywood is held back at edge of joist to catch beam bottom plywood. Sizing of support members will be determined according to design requirements.)

FIGURE 2


COLUMN CLEARANCE
DECK SHEATHING
I BEAM LEDGER
HORIZONTAL SHORE
PATENT SHORE

7. Repeat steps 2 to 6 to build required number of form sections

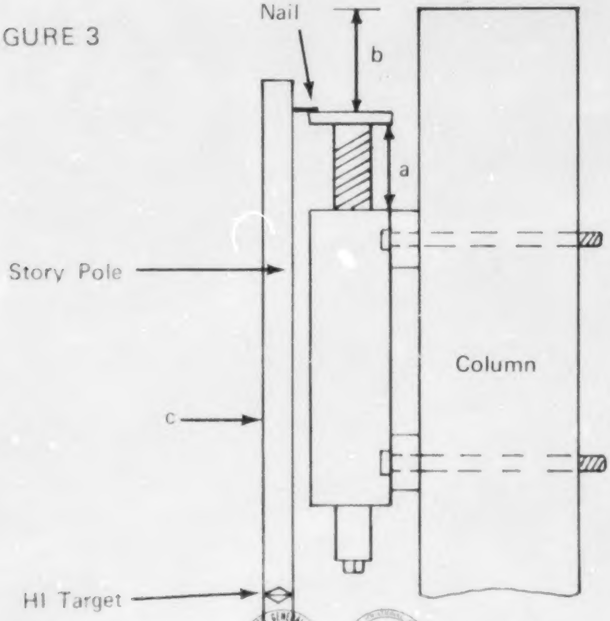
B. Attach patented shores to columns or wall

(NOTE: Pipe sleeves should have been placed in the proper location to receive shore bolts when the columns or wall was poured.)

C. Adjust shore top plate to proper elevation (Figure 3)

(NOTE: This can be done by measuring distance a, shore head extension from body of shore; distance b, plate to the top of the column; or c, using builder's level and story pole, as shown in Figure 3.)

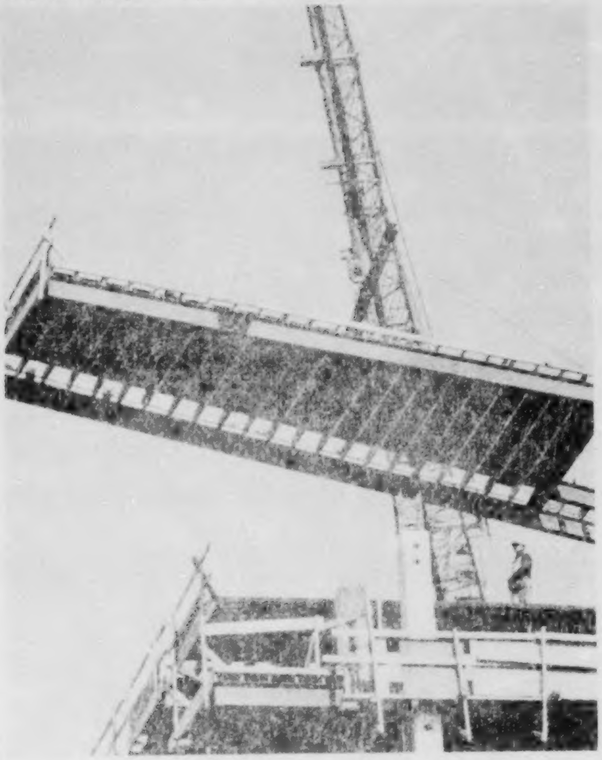
FIGURE 3


Nail
b
a
Story Pole
Column
c
HI Target

JOB SHEET #3

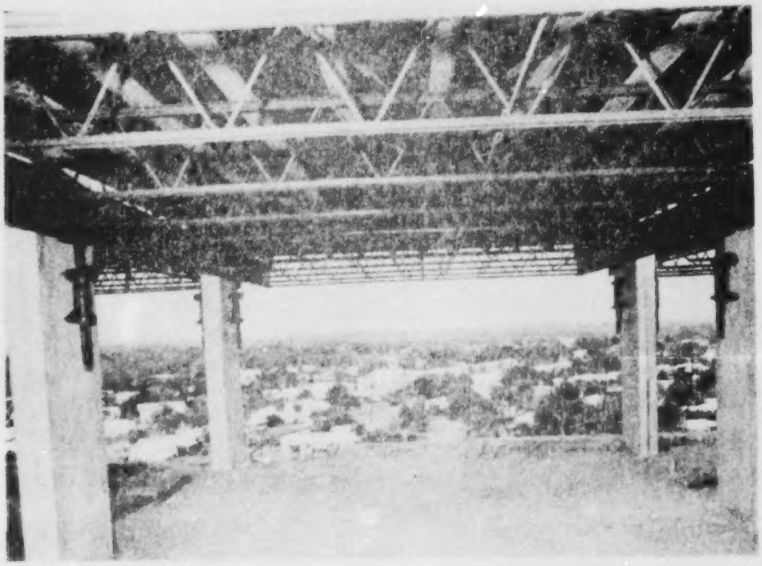
D. Use a crane to pick up forms (Figure 4)

FIGURE 4



E. Set form sections on shores (Figure 5)

FIGURE 5

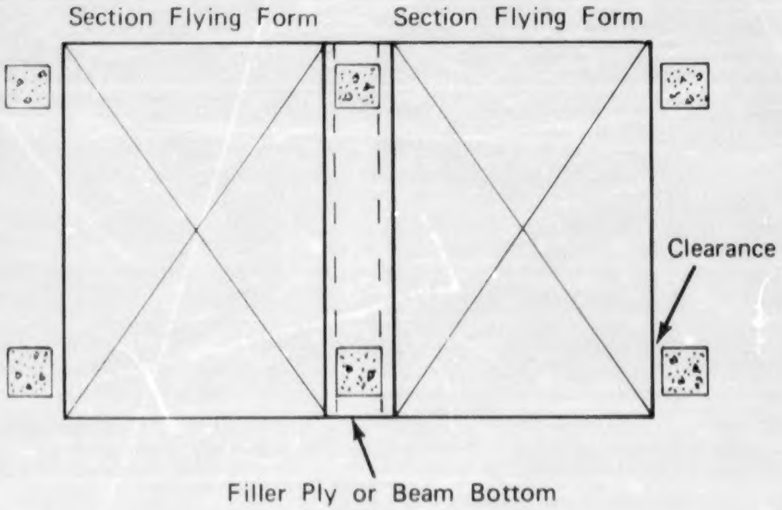


JOB SHEET #3

F. Install beam bottom plywood (Figure 6)

(NOTE: This is done after adjacent sections are set.)

FIGURE 6


Section Flying Form
Section Flying Form
Clearance
Filler Ply or Beam Bottom

G. Install edge form

(NOTE: This is done after all form sections are set.)

1. Cut form material to proper width
2. Mark points on the deck indicating the outside of the form
3. Snap a chalk line between those points
4. Nail form kicker to deck
5. Nail edge form to kicker
6. Align and brace
7. Apply form oil to all surfaces which will come in contact with concrete

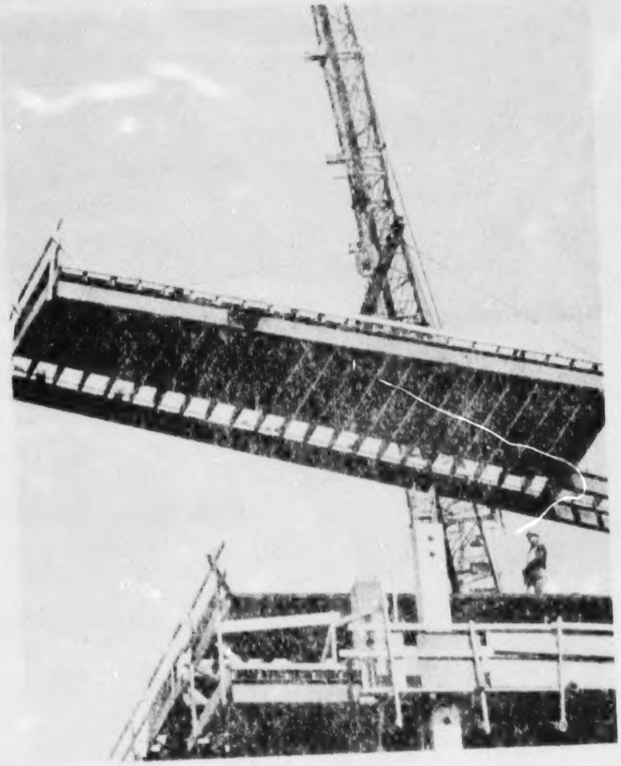
   (NOTE: Check anchor supplier's details for hole spacings.)

1216

JOB SHEET #3

H. Move form to next pour location after slab is poured, cured, and ready for stripping (Figure 7)

FIGURE 7



1. Lower shore adjustments until I beam ledger is resting on roller

   (NOTE: Care should be exercised when lowering forms to avoid binding against columns. Be sure filler pieces at columns are removed.)

2. Roll form outside of building

3. Attach crane spreaders to form

4. Swing form clear of building and move it to next location

5. Repeat steps B, C, D, E, and F to continue erection

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

JOB SHEET #4--STRIP A TWO-WAY JOIST FORM SYSTEM (WAFFLE)

(NOTE: Steel dome systems are stripped very similarly.)

I. Tools and materials

   A. Tools

      1. Hammer, 16 oz or larger

      2. Wrecking bar, 24 inch or larger

      3. Air compresser, 100 to 125 psi

      4. Air hose

      5. Air gun

         (NOTE: This should be furnished by dome manufacturer.)

   B. Materials

      1. Form oil

      2. Burlap

II. Procedure

   A. Lower shore scaffold by loosening either upper or lower screws

      (NOTE: This should only be done after concrete has reached its designed stripping strength.)

   B. Loosen horizontal shore lock bolt

   C. Insert wrecking bar between the stringer and the end plate

   D. Telescope shore until it clears stringer

   E. Lower shore with other end still on stringer and tighten lock nut

      (CAUTION: This will prevent further telescoping and potential injury.)

   F. Insert wrecking bar between stringer and end plate and pry out second end of horizontal shore

   G. Repeat steps B to F to continue removing horizontal shores

      (CAUTION: Center of joist bottoms might be loosened during this period. Watch for loose members and remove them immediately.)

JOB SHEET #4

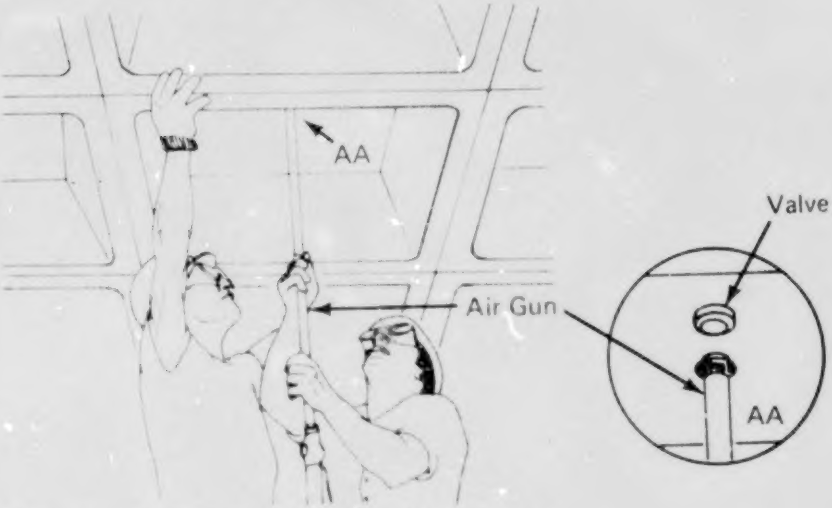
H. Strip all remaining joist bottom forms and beam bottom forms

I. Remove domes

1. Blow out domes with air gun (Figure 1)

   (NOTE: Never pry on flange of dome forms. Domes have special valves in top for insertion of air gun.)

FIGURE 1



Courtesy of CECO Steel Products Corporation

2. Look for problems if dome does not pop out
   - a. Air not going through stripping valve--Center punch stripping plug with nail or sharp rod and try to blow out again
   - b. Attachment to dome top--Make sure rivets or pins have been pulled or that special attachment fastenings are loose
   - c. Excessive grout seepage under flange--Chip concrete away with a hammer
   - d. Concrete-encrusted forms--Do not strip well so do not let them get that way

J. Clean domes

1. Scrape off any concrete on forms
2. Scrub domes with burlap saturated with form oil

   (NOTE: Follow manufacturer's recommendation as to type of form oil.)

JOB SHEET #4

3. Make a neat pile of the forms

   (NOTE: Do not throw domes; this will damage the flange. Follow manufacturer's recommendations for stacking.)

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

JOB SHEET #5--SET CONCEALED VOID TUBES

I. Tools and materials

- A. Tools
  1. Hammer, 16 oz or larger
  2. Chalk line
  3. Electric drill, 1/4" or 3/8"
  4. Pliers, side cutters
  5. Drill bits
- B. Materials
  1. Void tubes
  2. End caps
  3. Tie down spacers
  4. Wire, #12 annealed
  5. Slab bolsters

II. Procedure

- A. Drill holes for tie down wires

  (NOTE: Deck has been erected as for a flat slab.)

  1. Determine suggested spacing of tie-downs from table (Figure 1)

FIGURE 1

It is suggested that tie-downs be spaced as follows:

6" - 11" O.D. . . . 5' on center	18.7" - 24.8" O.D. . 3' on center
12" - 18.7" O.D. . 4' on center	24.8" - 36.9" O.D. . 2' on center

JOB SHEET #5

2. Locate first tie-down (Figure 2, Step 1)

   (NOTE: The first row of tie-downs should be not over one-half the table spacing from the end of the tube.)

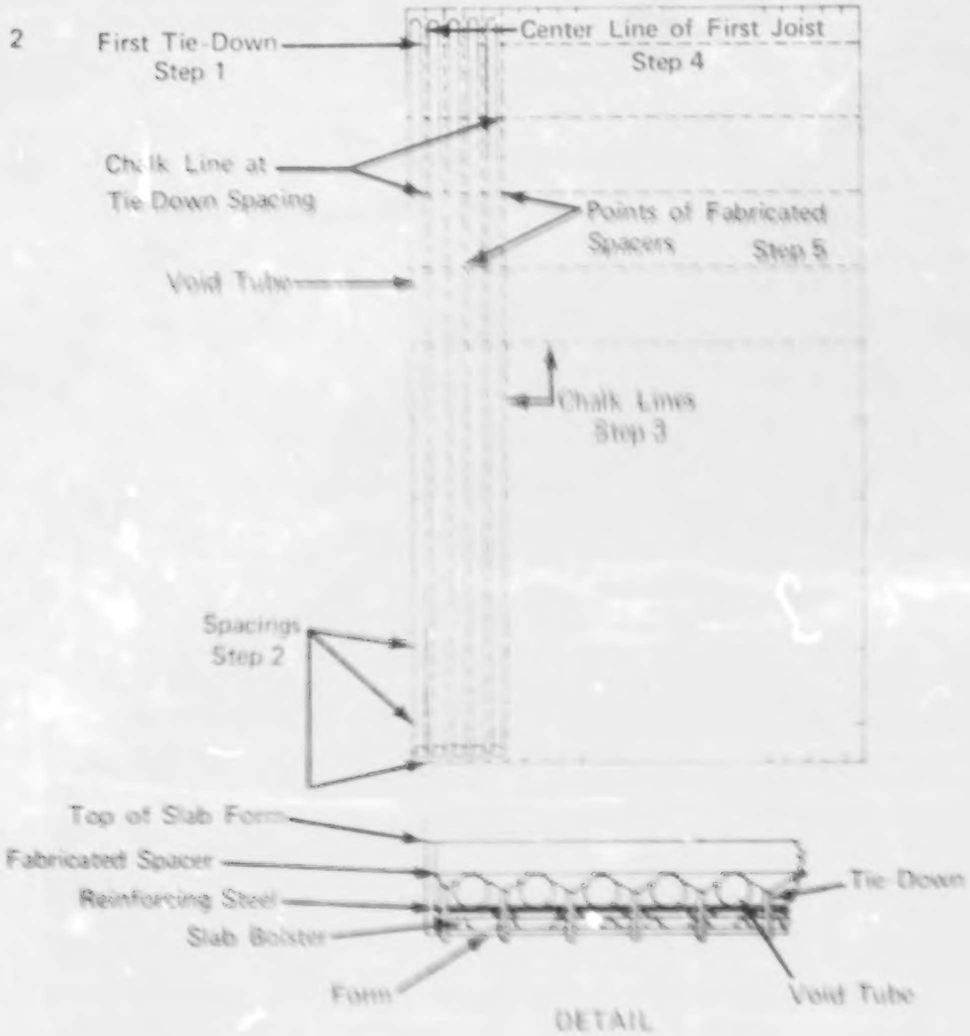
3. Lay out all spacing along the length and at each end of the void tube (Figure 2, Step 2)

4. Snap a chalk line to join layout points (Figure 2, Step 3)

5. Locate and snap a chalk line at center line of first joist (Figure 2, Step 4)

6. Lay fabricated spacer alongside chalk line with points at center line of joist (Figure 2, Step 5)

FIGURE 2


First Tie-Down
Step 1
Center Line of First Joist
Step 4
Chalk Line at
Tie-Down Spacing
Points of Fabricated
Spacers
Step 5
Void Tube
Chalk Lines
Step 3
Spacings
Step 2
Top of Slab Form
Fabricated Spacer
Reinforcing Steel
Slab Bolster
Tie-Down
Form
Void Tube
DETAIL

JOB SHEET #5

7. Drill holes through deck at points of fabricated spacer

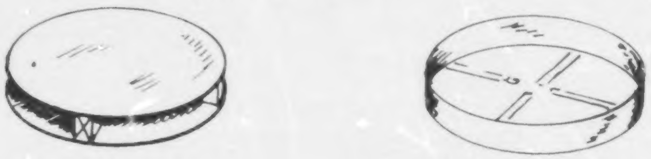
8. Repeat steps 6 and 7 to drill remaining holes

   (NOTE: Bottom rebars should be installed at this time.)

B. Set and anchor void tubes

1. Attach end closures to void tube (Figure 3)

FIGURE 3



HARDBOARD

METAL

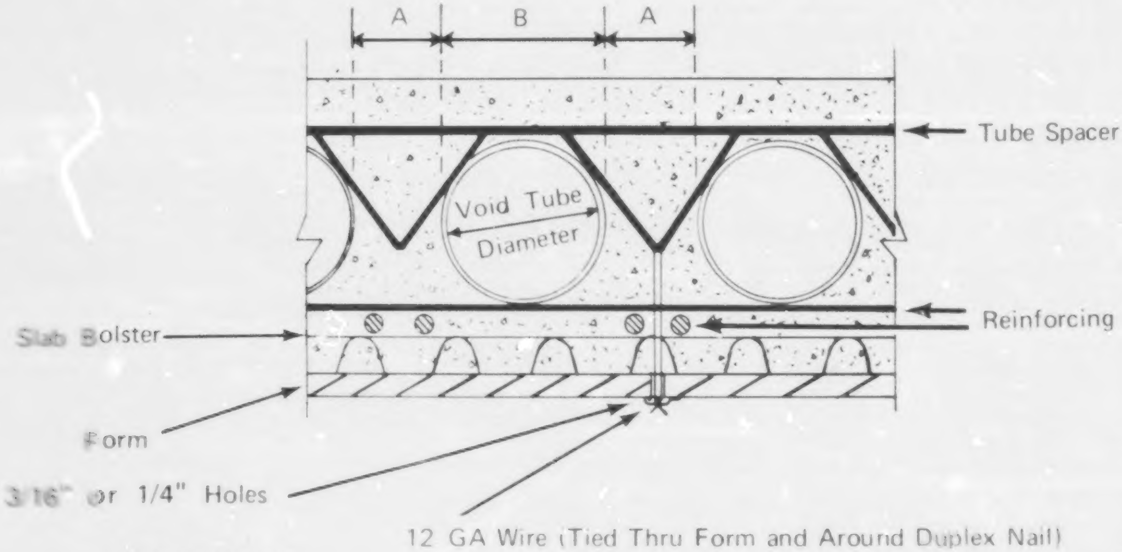
(NOTE: End enclosures can be made of wood or obtained from the manufacturer.)

2. Lay void tubes on rebars

3. Install spacer on void tubes (Figure 4)

   (NOTE: Void spacers are tied down to avoid possibility of tubes floating out of slab.)

FIGURE 4 DETAILS OF A METHOD FOR SPACING AND TIE-DOWN


A
B
A
Tube Spacer
Void Tube Diameter
Reinforcing
Slab Bolster
Form
3/16" or 1/4" Holes
12 GA Wire (Tied Thru Form and Around Duplex Nail)

A--Joist Width

B--Size Void

JOB SHEET #5

4. Cut wire to proper length

   (NOTE: See Figure 4 which illustrates tie wire installation.)

5. Secure tie-down spacers with precut wire as shown in Figure 4

   (NOTE: Tie-down wire is looped over tie-down spacer and both ends are inserted in predrilled hole in the deck and secured to a duplex nail driven into the underside of the deck.)

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. Terms and definitions are continued on the following page.

_____a. Piece of wood or other material that directs, resists, or supports weight or pressure

_____b. Piece of material nailed across a splice to strengthen and hold it together

_____c. Prop placed against or beneath an object for support

_____d. Piece of material used to resist horizontal pressure

_____e. Piece of heavy material placed across several shores; horizontal or inclined supporting member

_____f. Single or multistrand of high tensile wire or a rod used to stress concrete

_____g. Process of introducing internal stresses after concrete has reached a predetermined strength

_____h. Paraffin oil or other manufactured product applied to a form to prevent adhesion of concrete to the form

_____i. Horizontal board used to hold shores in alignment and to restrict lateral movement

_____j. Tapered piece of wood or metal

_____k. Single section of manufactured form used to mold exposed voids in a one-way joist system

_____l. Manufactured tube of metal or fiber used to create concealed voids in slabs

1. Void tube
2. Stringer
3. Wedge
4. Pan
5. Brace
6. Ribbon
7. Scab
8. Post-tensioning
9. Kicker
10. Tendon
11. Form oil
12. Shore

______m. Framing for pans and domes comprised of joist soffit forms and headers

______n. Horizontal sheathing that supports the wet concrete

______o. Manufactured product which forms an exposed void in a waffle slab system

______p. Design of a slab which is poured on domes; two-way joist system

______q. System whereby a large section of slab forms is removed with a crane and moved to the next pour location

______r. Horizontal timber laid directly on the ground or floor to support a frame structure

13. Flying forms
14. Dome
15. Open centering
16. Waffle
17. Deck
18. Mud sill

2. Identify the parts of a slab forming system by placing the correct numbers in the blanks below.

______a. Shore

______b. Joist soffit form

______c. Header

______d. Deck

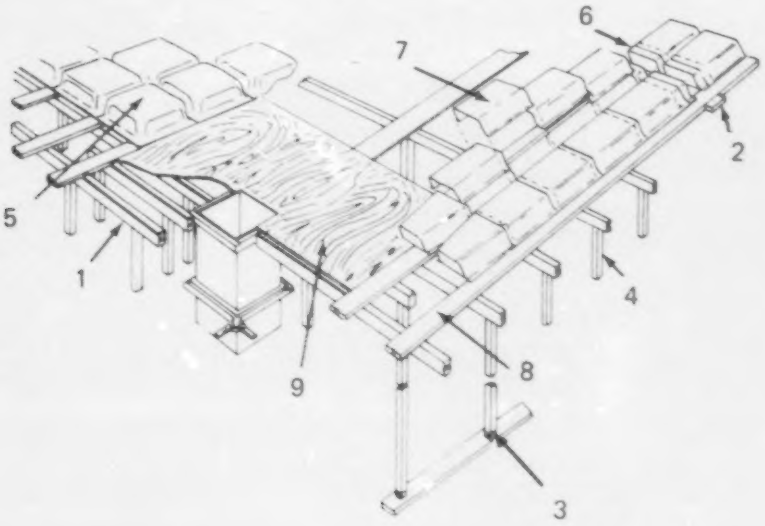
______e. Stringer

______f. Dome

______g. Pan

______h. Wedge

______i. End cap or enclosure



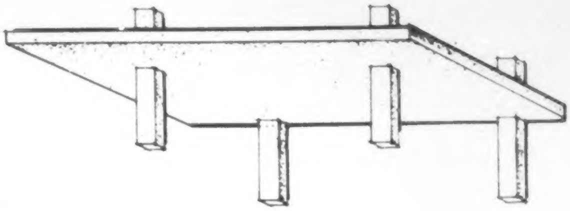
3. Identify the types of slabs pictured below. Write the correct names in the blanks provided.

a. ____

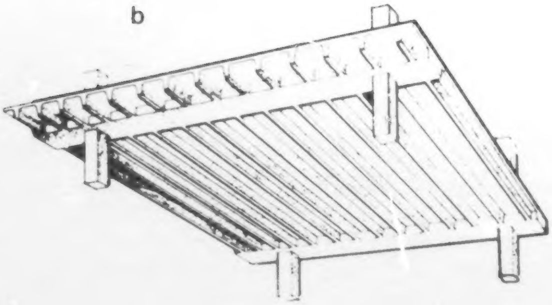
b. ____

c. ____

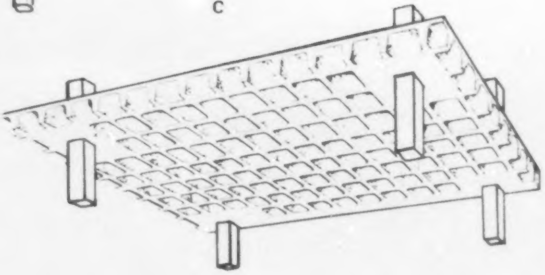
a



b



c



4. Name the types of slabs that can be post-tensioned.

____

____

____

5. List materials used to manufacture pans and domes.

a. ____

b. ____

c. ____

6. List materals used to manufacture void tubes.

   a. ____

   b. ____

7. Name types of manufactured exposed void forms.

   a. ____

   b. ____

   c. ____

   d. ____

8. Define *flying form*.

   ____

   ____

9. Demonstrate the ability to:

   a. Construct forms for a two-way joist system.

   b. Construct forms for a one-way joist system.

   c. Construct and erect forms for a flying flat slab form.

   d. Strip a two-way joist form system (waffle).

   e. Set concealed void tubes.

   (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

ABOVE GRADE SLAB SYSTEMS
UNIT VIII

ANSWERS TO TEST

1. a. 5
   b. 7
   c. 12
   d. 9
   e. 2
   f. 10
   g. 8
   h. 11
   i. 6
   j. 3
   k. 4
   l. 1
   m. 15
   n. 17
   o. 14
   p. 16
   q. 13
   r. 18
2. a. 4
   b. 8
   c. 2
   d. 9
   e. 1
   f. 5
   g. 7
   h. 3
   i. 6
3. a. Flat slab
   b. One-way joist
   c. Two-way joist (waffle)
4. All types of slabs can be post-tensioned
5. a. Molded fiberglass
   b. Steel
   c. Molded fiber (wood or paper)
6. a. Steel
   b. Fiber (paper)

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7. a. Adjustable form
   b. Flange form
   c. Long form
   d. Dome form
8. Slab forming system whereby large sections of forms are moved intact to another pour location by means of a crane or other lifting device
9. Performance skills evaluated to the satisfaction of the instructor

FIREPROOF ENCASEMENT FORMS
UNIT IX

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the parts of a form and list the major differences between fireproof encasement and structural concrete forms. The student should also be able to construct fireproof encasement forms for columns and beams. This knowledge will be evidenced by completion of the job sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with fireproof encasement forms to the correct definitions.
2. Define *fireproof encasement.*
3. State the purpose of fireproof encasement.
4. List types of special hardware used to erect fireproof encasement forms.
5. Identify the parts of a form.
6. List major differences between erection of fireproof encasement forms and structural concrete forms.
7. Demonstrate the ability to construct fireproof encasement forms for columns and beams.

FIREPROOF ENCASEMENT FORMS
UNIT IX

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Demonstrate and discuss procedures outlined in job sheet.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Beam Hanger and Joist Soffit

      2. TM 2--Parts of a Form

   D. Job Sheet #1--Construct Fireproof Encasement Forms for Columns and Beams

   E. Test

   F. Answers to test

III. Unit references:

   A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago, Illinois: American Technical Society, 1955.

   B. Smith, Ronald C. *Principles and Practices of Heavy Construction*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

FIREPROOF ENCASEMENT FORMS
UNIT IX

INFORMATION SHEET

I. Terms and definitions

   A. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure

   B. Beam bottom--That part of a beam form which supports the vertical pressure

   C. Beam side--Stud frame and sheathing section which comprises the vertical section of a beam form

   D. Monolithic pour--Continuous mass of concrete cast as a single unit

   E. Beam hanger--Steel hanger which supports the beam and slab forms

   F. Soffit spacer--Nut which is part of the beam hanger

   G. Ledger--Horizontal board nailed to a form to support intersecting horizontal members

   H. Stringer--Piece of material placed across several shores; a horizontal or inclined supporting member

   I. Form oil--Paraffin oil or other manufactured product used on a form to prevent adhesion of concrete to the form

II. Fireproof encasement--Encasing structural steel members in concrete

III. Purpose of fireproof encasement--To protect the structural steel against deterioration caused by overheating

IV. Special hardware used to erect fireproof encasement forms (Transparency 1)

   A. Beam hangers

   B. Soffit spacers

V. Parts of a form (Transparency 2)

   A. Beam side

   B. Beam hanger

   C. Decking

INFORMATION SHEET

D. Joist

E. Stringer

F. Column clamp

G. Ledger

H. Ledger support leg

I. Kicker

J. Beam bottom

K. Beam hanger shim

L. Soffit spacer

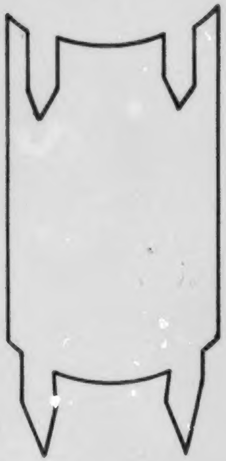
VI. Major differences between erection of fireproof encasement forms and structural concrete forms

A. Through ties can not be used on fireproof encasement forms

B. Shores do not have to be used to support beam and slab forms for fireproof encasement

Beam Hanger and Joist Soffit

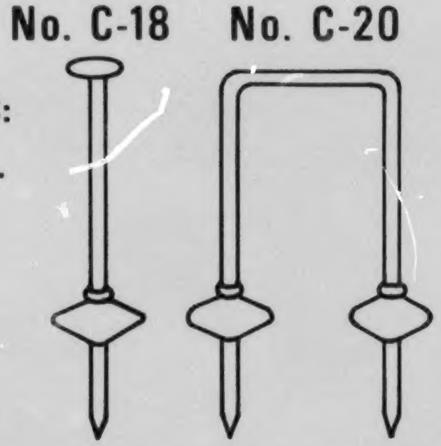
Made in 1" to 4" lengths as required.



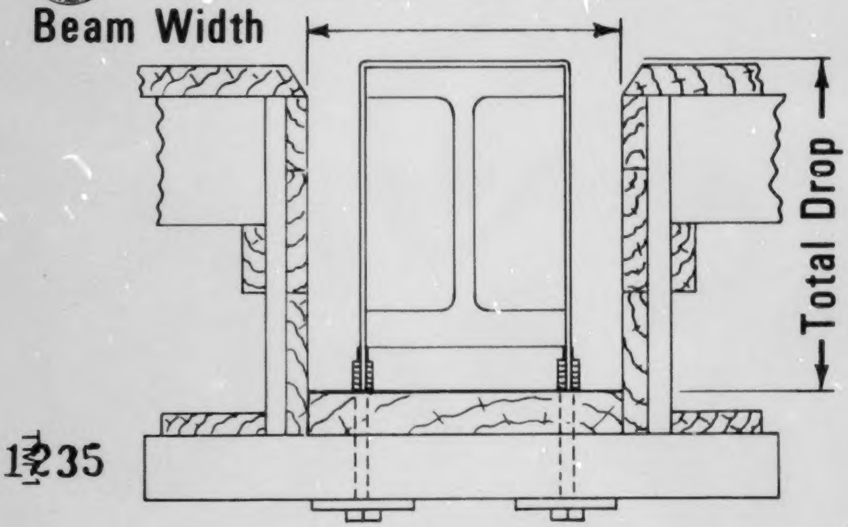
Soffit Spacer

Available in these sizes:
1 1/2"; 2"; 3".

They can also be furnished in heights over 3".

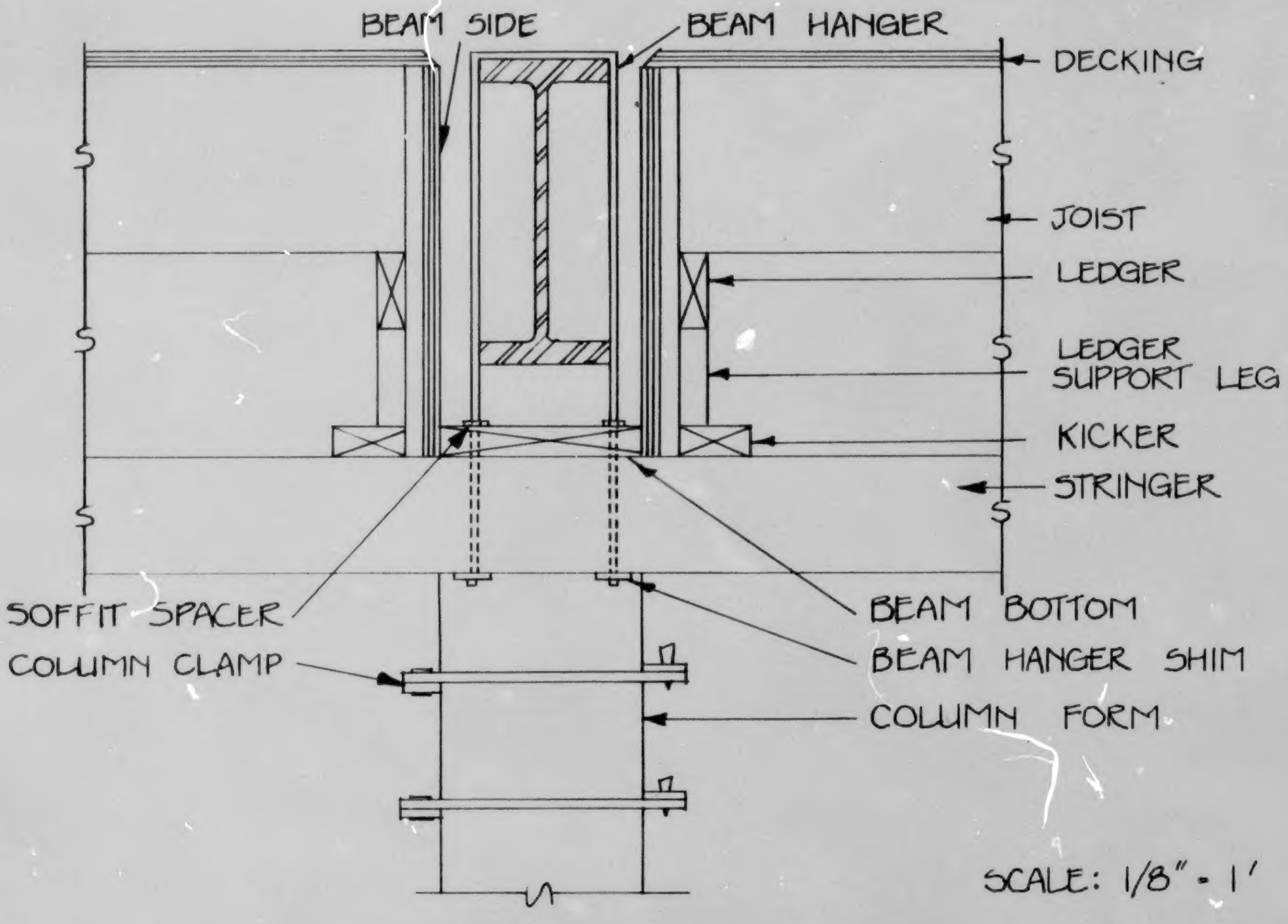


Single and Double Spacers



Same construction as standard coil tie. Working loads per side: 3000 lbs. for 1/2", 7500 lbs. for 3/4" and 10,000 lbs. for 1". Ordering: Give beam width, diameter, and total drop.

Parts of a Form


BEAM SIDE
BEAM HANGER
DECKING
JOIST
LEDGER
LEDGER SUPPORT LEG
KICKER
STRINGER
SOFFIT SPACER
BEAM BOTTOM
COLUMN CLAMP
BEAM HANGER SHIM
COLUMN FORM
SCALE: 1/8" = 1'

FIREPROOF ENCASEMENT FORMS
UNIT IX

JOB SHEET #1--CONSTRUCT FIREPROOF ENCASEMENT FORMS FOR COLUMNS AND BEAMS

(NOTE: Forms for structural concrete columns and beams are constructed very similarly.)

I. Tools and materials

   A. Tools

      1. Hammer, 16 oz or larger
      2. Handsaw, crosscut
      3. Electric handsaw
      4. String line
      5. Electric drill
      6. Drill bits, size of hanger

   B. Materials

      1. Sheathing, plywood
      2. Stringers, 4 x 4's
      3. Beam bottom, 2"-thick material
      4. 2 x 4's for studs, top plates, and kickers
      5. 1 x 4's for bottom plates and cleats
      6. Soffit spacers
      7. Column clamps
      8. Ledgers, 2 x 6's
      9. Ledger support legs, 2 x 4's

II. Procedure

   A. Secure material

   B. Determine size of beams and columns

JOB SHEET #1

C. Cut material to size

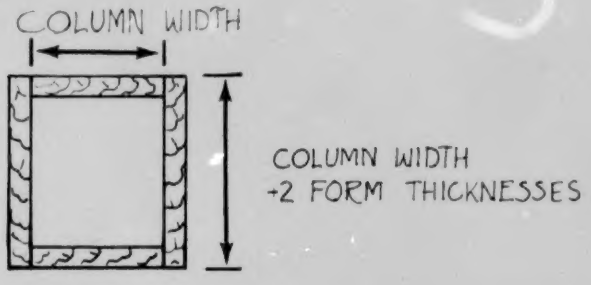
1. Cut stringers to length

   (NOTE: Stringer should extend past beam forms on each side to support deck and beam side kicker.)

2. Cut column plywood to size (Figure 1)

   (NOTE: The height of the column form will be the distance from the floor to the underside of the decking.)

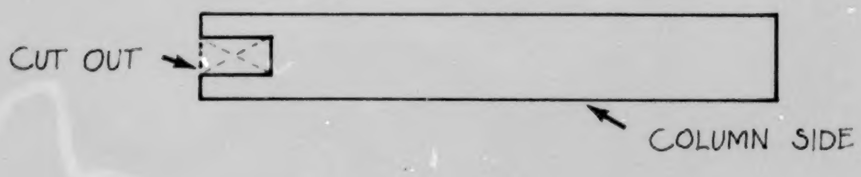
FIGURE 1


COLUMN WIDTH
COLUMN WIDTH +2 FORM THICKNESSES

3. Cut out beam pocket in column side (Figure 2)

   (NOTE: The size of the beam pocket should show the beam bottom and beam sides to extend to the inside of the column form.)

FIGURE 2

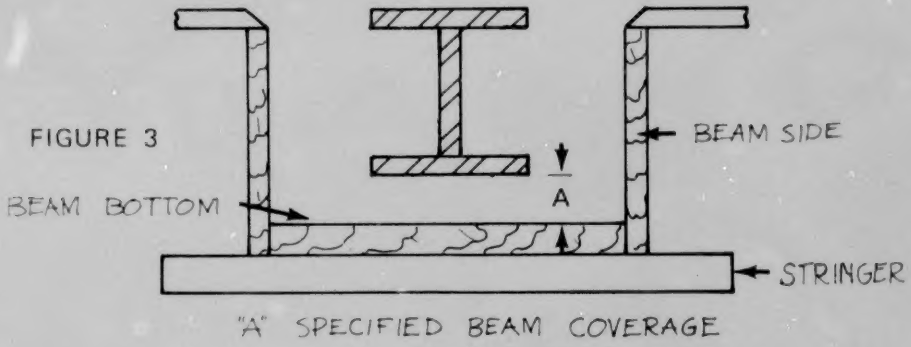

CUT OUT
COLUMN SIDE

JOB SHEET #1

4. Cut beam plywood to size (Figure 3)

   (NOTE: Beam side should set on the stringer and the decking should set on the beam side.)

FIGURE 3


BEAM SIDE
BEAM BOTTOM
A
STRINGER
"A" SPECIFIED BEAM COVERAGE

5. Cut column studs

   (NOTE: Column studs will be the same length as the beam sides.)

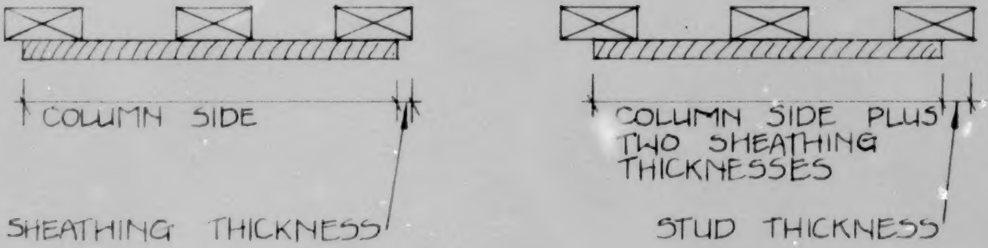
6. Cut beam studs

   (NOTE: Beam studs will be the height of the beam side minus the top and bottom plates.)

D. Assemble column and beam sides

   1. Assemble the column sides (Figure 4)

FIGURE 4


COLUMN SIDE
SHEATHING THICKNESS
COLUMN SIDE PLUS TWO SHEATHING THICKNESSES
STUD THICKNESS

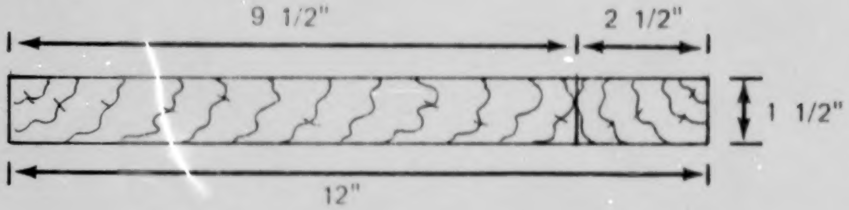
JOB SHEET #1

2. Assemble the beam sides
   a. Lay out stud spacing on plate
   b. Nail studs to plates
   c. Nail sheathing to studs

E. Build beam bottom (Figure 5)

1. Cut filler piece to correct width

FIGURE 5

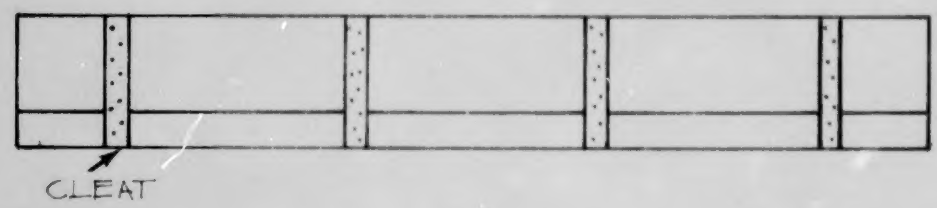


(NOTE: If a 2 x 4 was used to cut the 2 1/2" piece, there would be 1" waste. Two pieces 2 1/2" wide can be cut from a 2 x 6 with less than 1/2" waste for the two pieces.)

2. Cleat the pieces together (Figure 6)

(NOTE: Space cleats to miss beam hanger location.)

FIGURE 6



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JOB SHEET #1

3. Drill holes for hangers in beam bottom
4. Drill holes in stringer to match cross spacing in beam bottom

F. Coat all forms with form oil

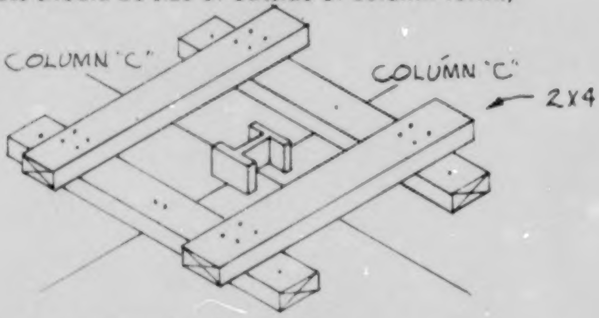
G. Erect column forms

(NOTE: If any type of reinforcing is called for, it should be installed on columns and beams before forms are erected.)

1. Lay out column center lines
2. Nail column template to floor (Figure 7)

(NOTE: Template should be size of outside of column form.)

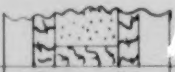
FIGURE 7



3. Determine column clamp spacing (Figure 8)

(NOTE: Raise bottom spacing to clear template.)

FIGURE 8



0' 0"			
	Clamp #1	6"	1
Height of Column	" #2	24"	2
	" #3	24"	3
	" #4	24"	4
8' 0"	" #5	18"	5
10' 0"	" #6	18"	
12' 0"	" #7	18"	
	" #8	15"	
14' 0"	" #9	15"	
	" #10	12"	
16' 0"	" #11	12"	
	" #12	12"	
18' 0"	" #13	12"	
	" #14	9"	
	" #15	9"	
	" #16	9"	
20' 0"		3"	

Column Clamp Spacing

JOB SHEET #1

4. Lay out template for column clamp spacing

5. Stand opposite column sides in template and nail corner studs

   (NOTE: Use duplex nails.)

6. Stand the other two sides in template and nail as in Figure 9b

7. Stand template at column corners and mark clamp locations on corner studs

8. Drive a 16d nail at each mark (Figures 9a and 9b)

   (NOTE: These nails serve to support the clamp during installation. Check type of clamp being used for side location of nails.)

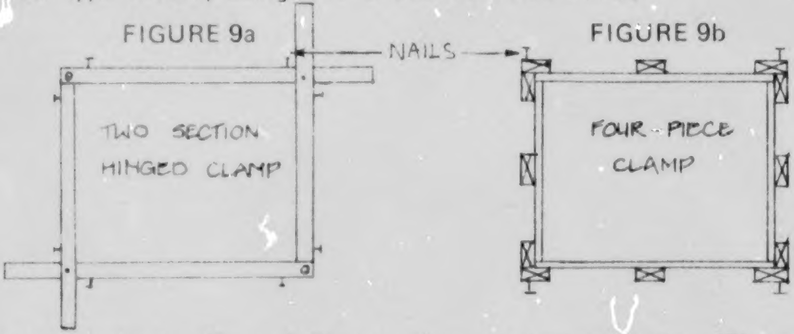
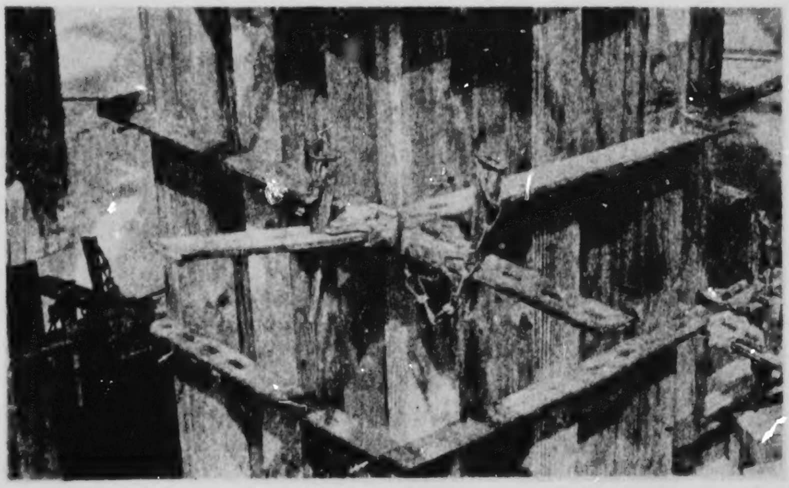


FIGURE 9a
NAILS
FIGURE 9b
TWO SECTION HINGED CLAMP
FOUR-PIECE CLAMP

9. Lay sections of column clamp on column and secure wedges (Figure 10)

FIGURE 10



10. Place a wood spacing block between the stud beam and form to hold it plumb

JOB SHEET #1

H. Hang beam bottoms

1. Place beam hanger over steel beam close to end of first section of beam bottom

2. Nail a stringer to beam bottom

   (NOTE: This should be on the end away from the column. Line up holes for hanger.)

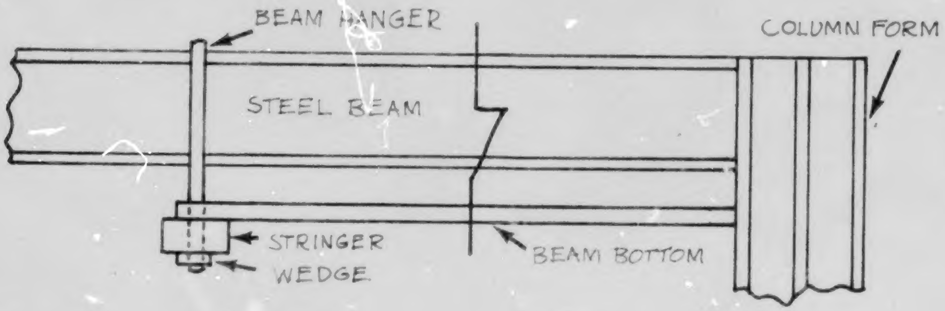
3. Drive soffit spacers into beam bottom

4. Insert one end of the beam bottom into pocket cut out in column side

5. Raise the other end and insert beam hanger in predrilled holes

6. Install and secure wedges (Figure 11)

FIGURE 11



7. Install intermediate beam hangers

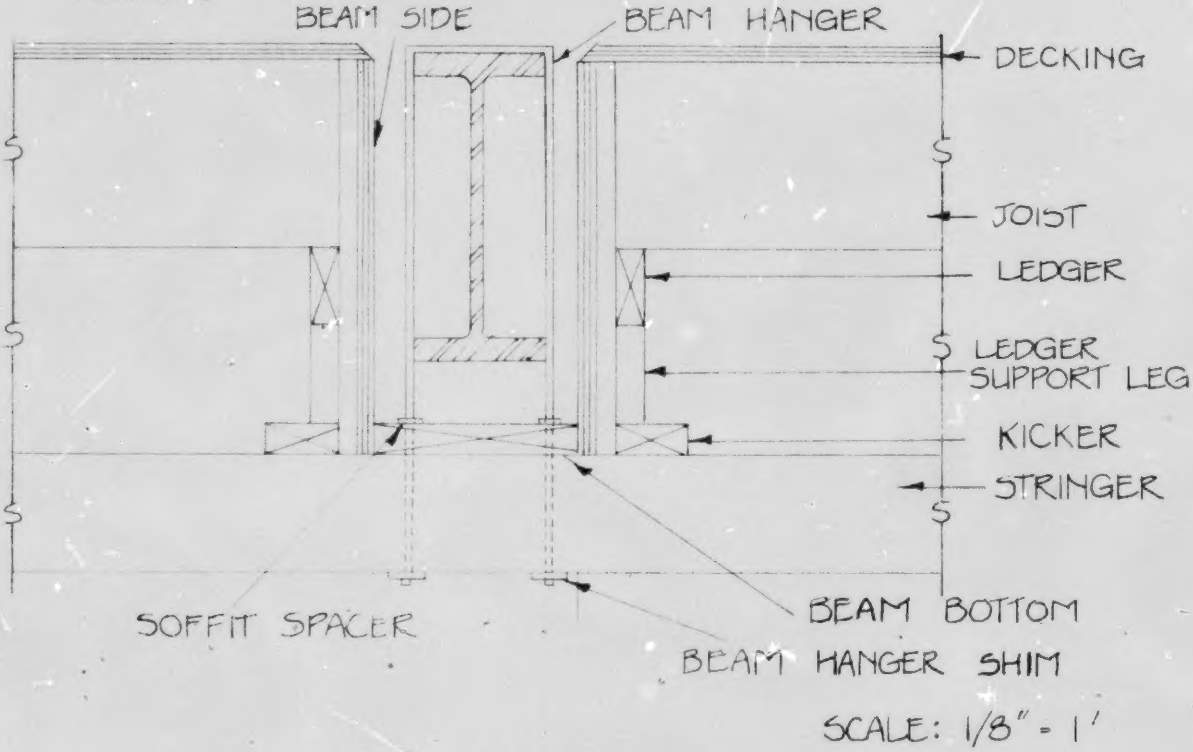
8. Repeat steps 1 through 7 to continue erection

   (NOTE: The first end of the beam bottom will rest on the stringer instead of the column form.)

JOB SHEET #1

I. Install beam sides, kicker, and ledger (Figure 12)

FIGURE 12


BEAM SIDE
BEAM HANGER
DECKING
JOIST
LEDGER
LEDGER SUPPORT LEG
KICKER
STRINGER
SOFFIT SPACER
BEAM BOTTOM
BEAM HANGER SHIM
SCALE: 1/8" = 1'

1. Nail beam side to stringer and beam bottom
2. Nail continuous kicker to stringer
3. Nail ledger to studs

   (NOTE: Ledger is located to place the top of the joist flush with the top of the beam side.)

4. Cut ledger support legs to length and nail to studs
5. Align top of beam
   a. Cleat across the beam sides to establish correct width
   b. Insert correct length spacer between form and flange of beam to align

(NOTE: The forms are now ready to receive joist and decking for a flat slab.)

FIREPROOF ENCASEMENT FORMS
UNIT IX

TEST

NAME ______________________________ SCORE ____________

1. Match the following terms to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Piece of wood or other material that directs, resists, or supports weight or pressure

______b. That part of a beam form which supports the vertical pressure

______c. Stud frame and sheathing section which comprises the vertical section of a beam form

______d. Continuous mass of concrete cast as a single unit

______e. Steel hanger which supports the beam and slab forms

______f. Nut which is part of the beam hanger

______g. Horizontal board nailed to a form to support intersecting horizontal members

______h. Piece of material placed across several shores; a horizontal or inclined supporting member

______i. Paraffin oil or other manufactured product used on a form to prevent adhesion of concrete to the form

1. Soffit spacer
2. Monolithic pour
3. Brace
4. Stringer
5. Beam side
6. Ledger
7. Form oil
8. Beam hanger
9. Beam bottom

2. Define *fireproof encasement.*

____

____

____

____

3. State the purpose of fireproof encasement.

____

____

4. List types of special hardware used to erect fireproof encasement forms.

a. ____

b. ____

5. Identify the parts of the form illustrated below by placing the appropriate numbers in the blanks provided.

______a. Beam side

______b. Beam hanger

______c. Decking

______d. Joist

______e. Stringer

______f. Column clamp

______g. Ledger

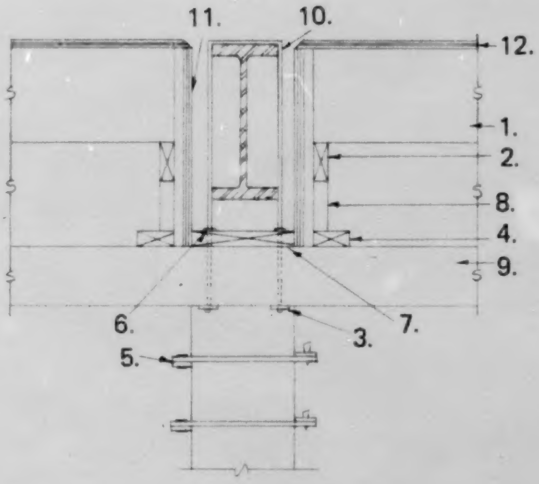
______h. Ledger support leg

______i. Kicker

______j. Beam bottom

______k. Beam hanger shim

______l. Soffit spacer



6. List major differences between the erection of fireproof encasement forms and structural concrete forms.

a. ____

b. ____

7. Demonstrate the ability to construct fireproof encasement forms for columns and beams.

(NOTE: If this activity has not been accomplished prior to the test, ask the instructor when it should be completed.)

FIREPROOF ENCASEMENT FORMS
UNIT IX

ANSWERS TO TEST

1. a. 3
   b. 9
   c. 5
   d. 2
   e. 8
   f. 1
   g. 6
   h. 4
   i. 7
2. Encasing structural steel members in concrete
3. To protect structural steel against deterioration caused by overheating
4. a. Beam hangers
   b. Soffit spacers
5. a. 11
   b. 10
   c. 12
   d. 1
   e. 9
   f. 5
   g. 2
   h. 8
   i. 4
   j. 7
   k. 3
   l. 6

6. a. Through ties can not be used on fireproof encasement forms

   b. Shores do not have to be used to support beam and slab forms for fireproof encasement

7. Performance skills evaluated to the satisfaction of the instructor

STAIR FORMS
UNIT X

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the parts of a stair form, name the types of concrete stairs, and identify stair plan shapes. The student should also be able to identify details of stair forms and construct forms for suspended stairs, forms for stairs on earth, and forms for short flights of stairs. This knowledge will be evidenced by completion of job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with stair forms to the correct definitions.
2. Identify the parts of a stair form.
3. Name types of concrete stairs.
4. Identify stair plan shapes.
5. Name types of stair slabs.
6. Identify details of stair forms for each type of slab.
7. State rule of thumb for unit rise and unit run.
8. Calculate the number of risers and treads for a stair of given dimensions.
9. Demonstrate the ability to:
    a. Construct forms for suspended stairs.
    b. Construct forms for stairs on earth.
    c. Construct forms for short flights of stairs.

STAIR FORMS
UNIT X

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Parts of a Stair Form
      2. TM 2--Types of Concrete Stairs
      3. TM 3--Stair Plan Shapes
      4. TM 4--Stair Plan Shapes (Continued)
      5. TM 5--Types of Stair Slabs
      6. TM 6--Suspended Slab Stair Forms
      7. TM 7--Suspended Slab Stair Forms (Continued)
      8. TM 8--Earth-Supported Stair Slab Forms
      9. TM 9--Rise and Run of Stairs
      10. TM 10--Unit Rise and Unit Run

D. Job sheets

1. Job Sheet #1--Construct Forms for Suspended Stairs
2. Job Sheet #2--Construct Forms for Stairs on Earth
3. Job Sheet #3--Construct Forms for Short Flights of Stairs

E. Test

F. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago, Illinois: American Technical Society, 1955.

B. *Concrete Form Construction.* Albany, New York: Delmar Publishers.

STAIR FORMS
UNIT X

INFORMATION SHEET

I. Terms and definitions

A. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure

B. Key--Beveled piece of wood or metal placed in a form where future pours occur

C. Scab--Piece of wood or metal secured across a splice to strengthen and hold the two pieces together

D. Decking--Wide boards, plywood, or metal that make up the horizontal face of a form

E. Stake--Small board or steel bar sharpened at one end and driven into the ground to support the form

F. Form oil--Paraffin oil or a manufactured product used on a form to prevent adhesion of the concrete to the form

G. Horse--Inclined supporting member of a stair form or stair

H. Landing--Platform between flights of stairs

I. Stair rise--Distance from the floor to the top of a landing or to the floor above

J. Riser--Vertical part of a stair step

K. Stair run--Horizontal distance between the first riser and the face of the platform or stair opening above

L. Tread--Horizontal part of a stair step

M. Pitch board--Wood block used to lay out or support treads and risers

N. Batter--Forward inclination of a riser

O. Bent--Framework designed to carry lateral as well as vertical loads

P. Stairwell--Compartment extending vertically through a structure and in which stairs are placed

Q. Framing square gauge--Device attached to a framing square to secure accuracy when laying out material

INFORMATION SHEET

R. Kicker--In construction, a piece of wood or other material secured to a fixed object or wedged against an object to support weight or pressure

S. Bulkhead--Vertical board placed in a form to cut off the concrete pour

T. Spreader--Piece of wood or metal used to hold the sides of a form apart until the concrete is poured

II. Parts of a stair form (Transparency 1)

A. Horse

B. Joist

C. Block

D. Riser form

E. Side form

F. Sheathing

G. Edge form

H. Brace

I. Stringer

J. Shore

K. Wedge

L. Sill

M. Scab

N. Kicker

O. Center support

(NOTE: Bulkheads and spreaders are used only occasionally on stair forms. Therefore, they are not shown on Transparency 1.)

III. Types of concrete stairs (Transparency 2)

A. Rough

B. Finished

INFORMATION SHEET

IV. Stair plan shapes (Transparencies 3 and 4)

- A. Straight flight
- B. Straight flight with landing
- C. 90° flights with landing
- D. 90° flights with winders
- E. 180° flights with landing

V. Types of stair slabs (Transparency 5)

- A. Suspended
- B. Earth-supported

VI. Details of stair forms for each type of slab (Transparencies 6, 7, and 8)

- A. Suspended
- B. Earth-supported

VII. Rule of thumb for unit rise and unit run--Total of one riser and one tread should not be less than 16" or more than 18" (Transparencies 9 and 10)

- A. Unit rise should be 7" - 8"
- B. Unit run should be 9" - 11"

  (NOTE: As the rise increases, the run must decrease proportionally.)

  (CAUTION: All treads and all risers must be the same size for any given set of stairs.)

VIII. Calculating the number of risers and treads for a stair

- A. Risers
  1. Determine the total rise of the stair in inches

     (NOTE: The total rise of a stair is from the finished floor of the lower level to the top of the finished floor of the upper level.)

  2. Divide the total rise of the stair by seven to get the number of risers needed

     (NOTE: Seven inches is the minimum height of a riser.)

INFORMATION SHEET

3. Round back to the nearest whole number

   Example: Total rise is 7'-10 1/4" or 94 1/4"

   94 1/4" ÷ 7 = 13.46 or 13 7/16

   7/16 will not make a full riser so round back to 13 full risers; 94 1/4" ÷ 13 = 7.25" or 7 1/4" unit rise. There will be 13 risers of 7 1/4" each

B. Treads

1. Determine the total run of the stair in inches

   (NOTE: The total run of the stair is the horizontal distance from a point at the head of a stair to the outside edge of the last riser.)

2. Divide the total run of the stair by nine to get the number of treads needed

   (NOTE: Nine inches is the minimum width of a tread.)

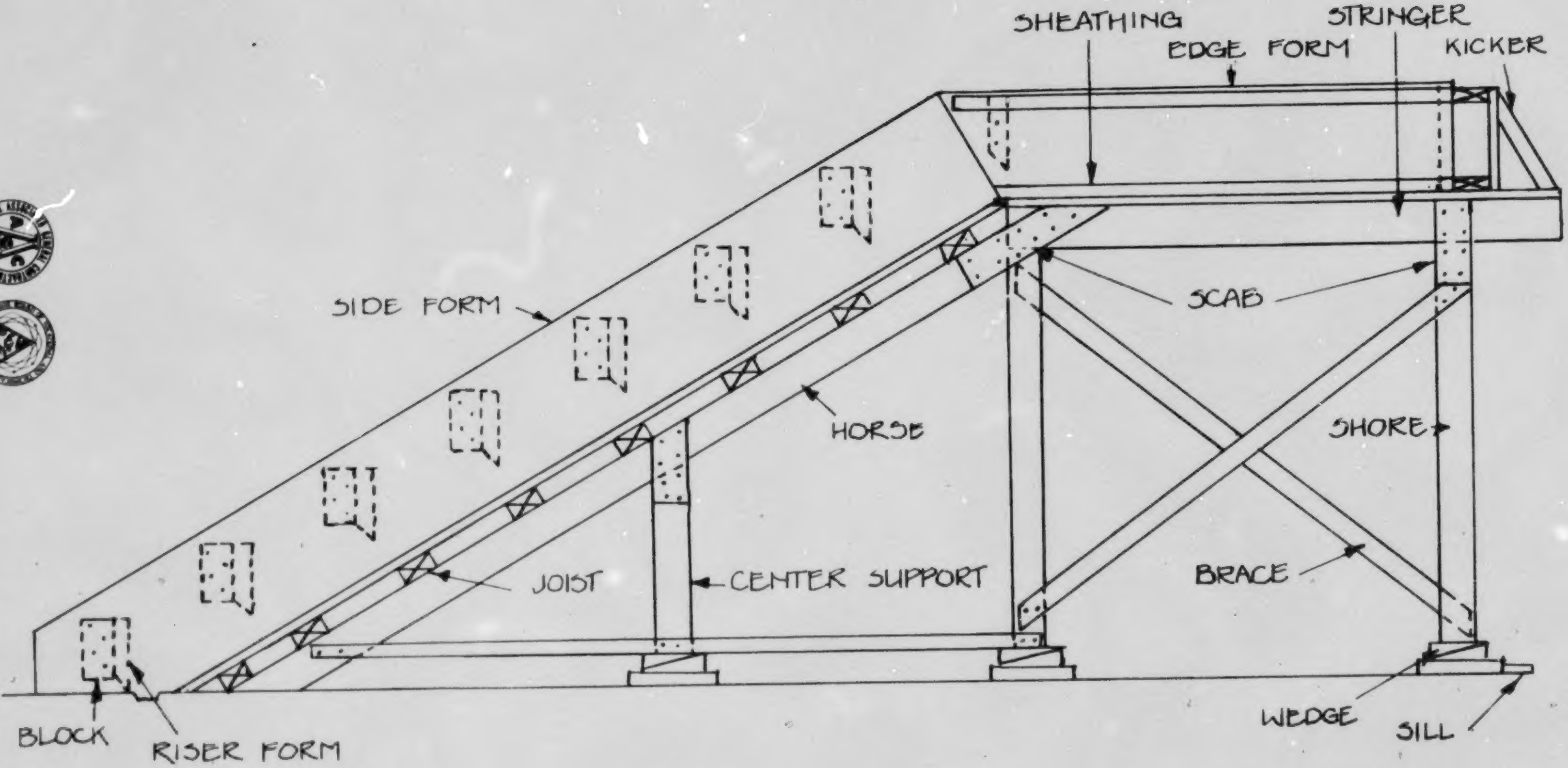
3. Round back to the nearest whole number

   Example: Total run for the stair is 9'-9" or 117"

   117 ÷ 9 = 13 full treads, 117" ÷ 13 = 9" unit run.

   There will be 13 treads of 9" each.

Parts of a Stair Form


SHEATHING
STRINGER
EDGE FORM
KICKER
SIDE FORM
SCAB
HORSE
SHORE
JOIST
CENTER SUPPORT
BRACE
BLOCK
RISER FORM
WEDGE
SILL

TM 1

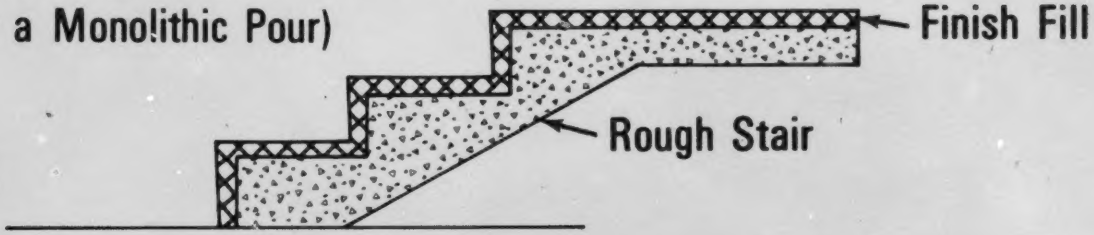
1258

1259

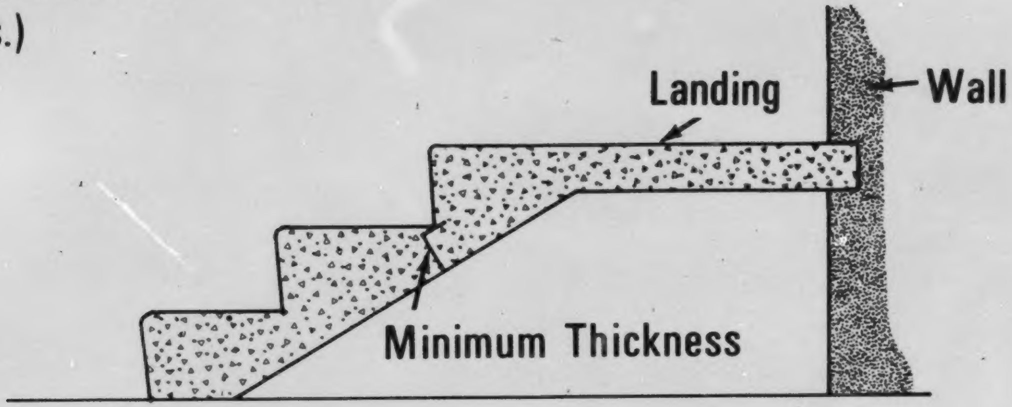
CC-481-G

Types of Concrete Stairs

ROUGH STAIR
(Not a Monolithic Pour)

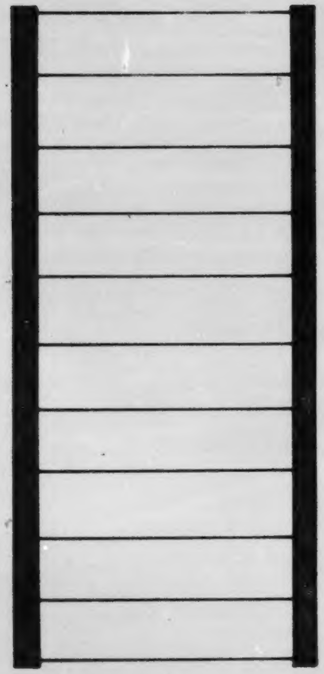

Finish Fill
Rough Stair

(Note: Finish Fill may be Terrazzo, Concrete, Ceramic Tile, Stone or other similar materials.)

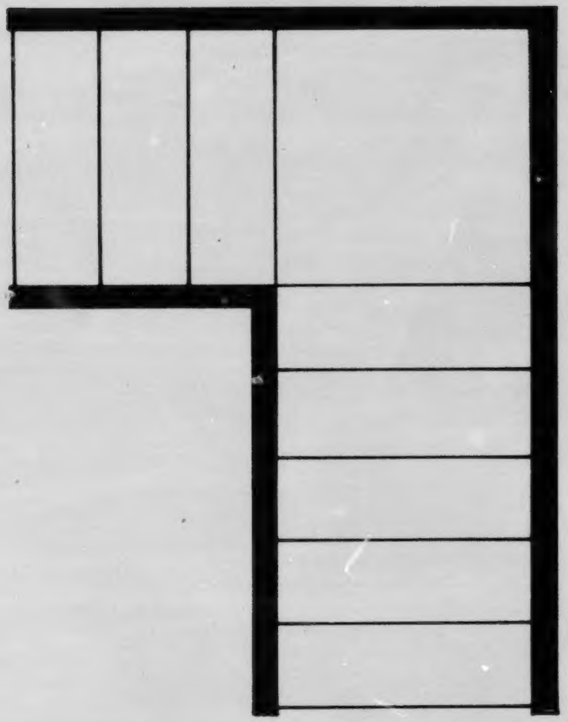

Landing
Wall
Minimum Thickness

FINISHED STAIR
(Monolithic Pour)

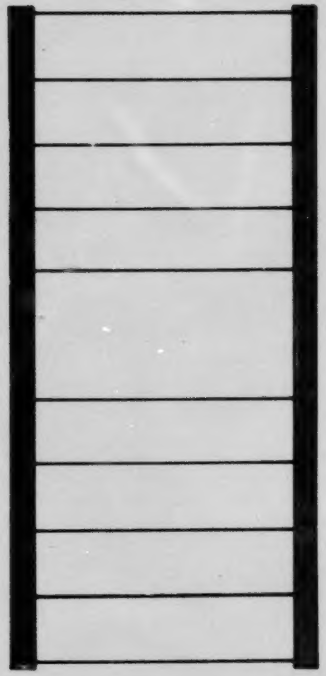
Stair Plan Shapes



STRAIGHT FLIGHT



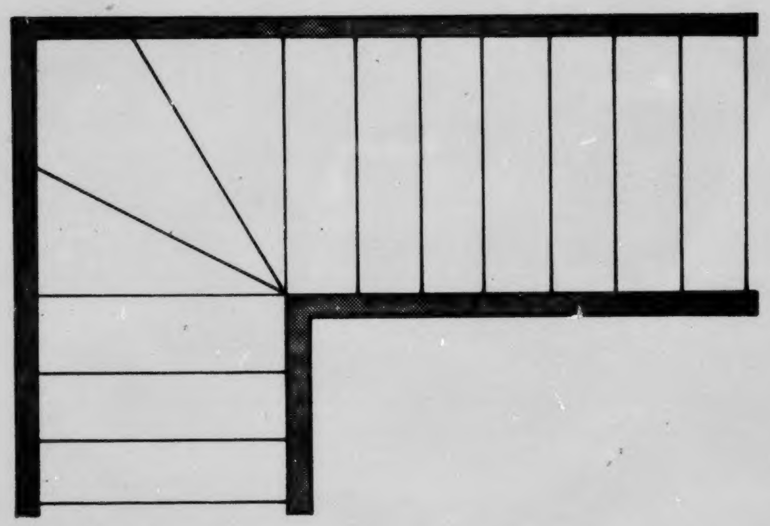
90° FLIGHTS
WITH LANDING



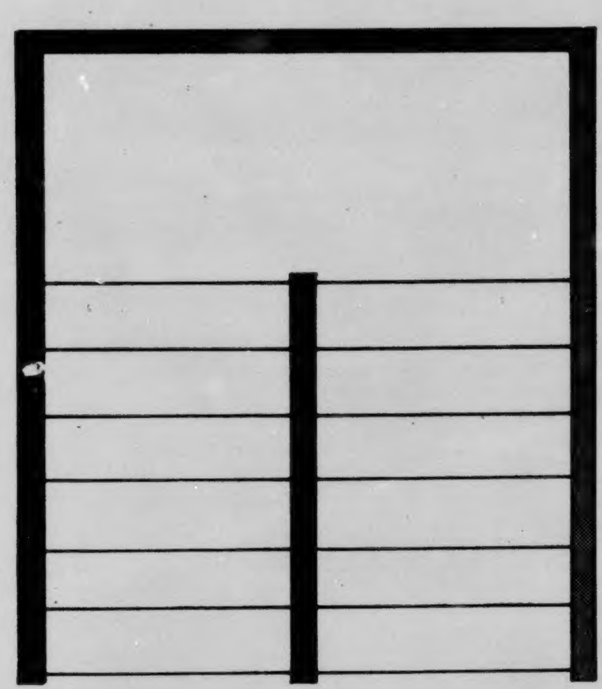
STRAIGHT FLIGHT
WITH LANDING

Stair Plan Shapes

(CONTINUED)

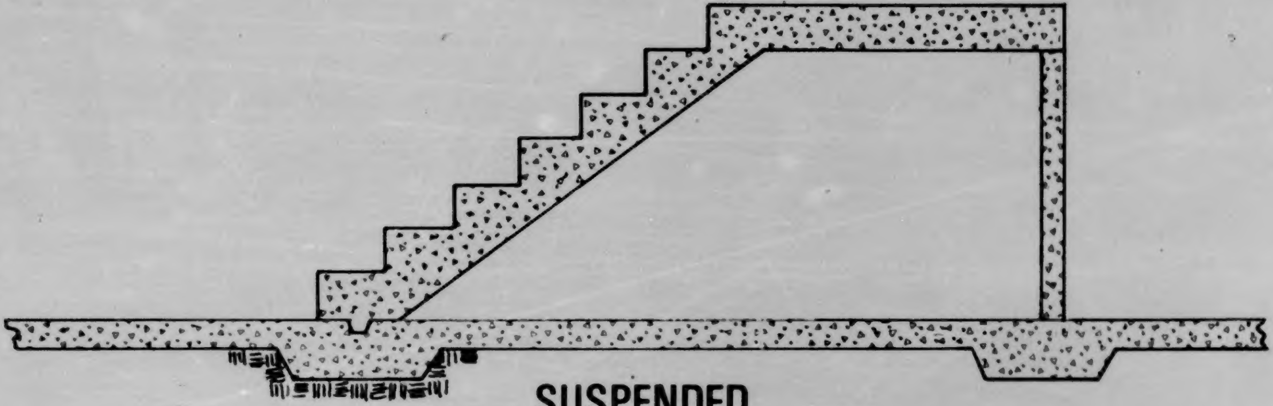


90° FLIGHTS WITH WINDERS

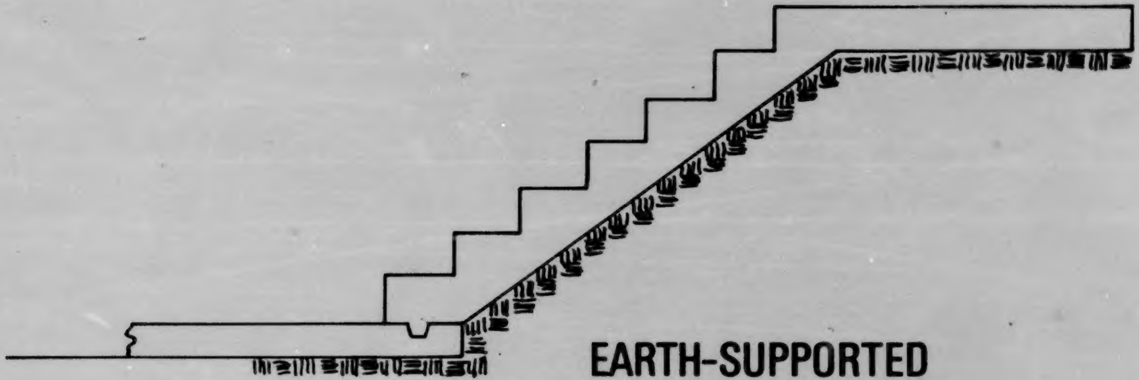


180° FLIGHTS WITH LANDING

Types of Stair Slabs

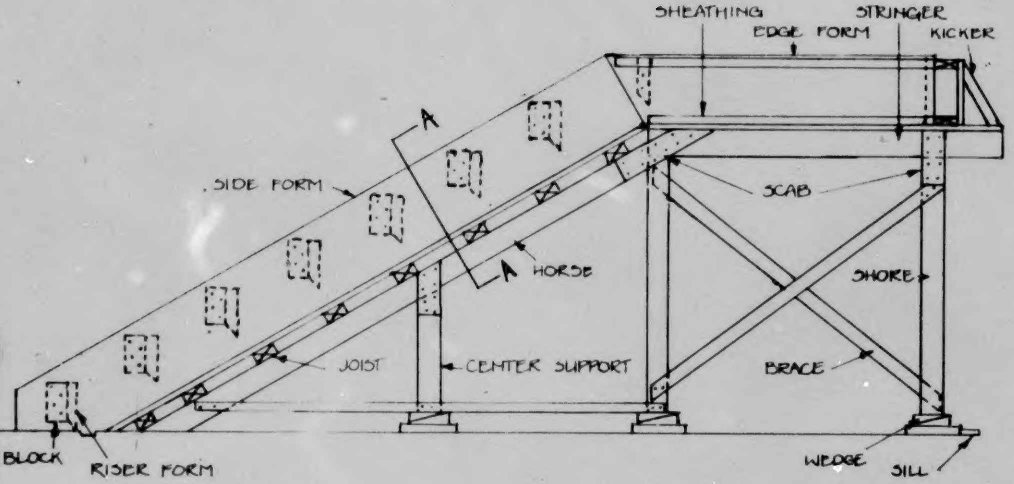


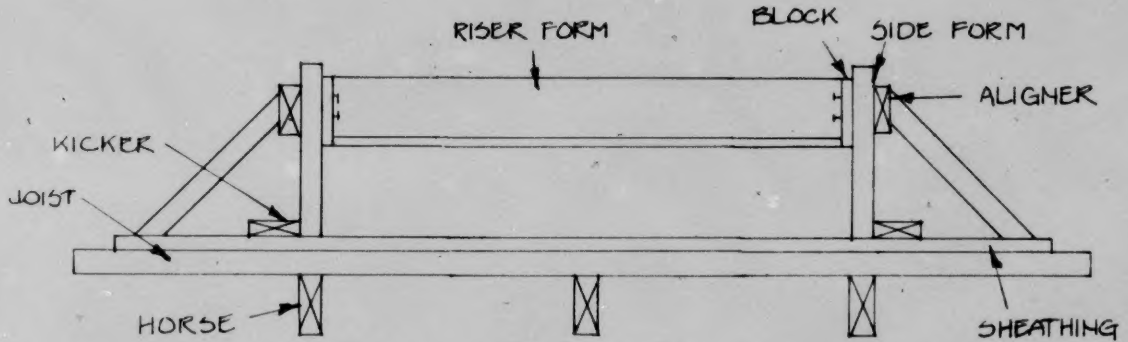
SUSPENDED



EARTH-SUPPORTED

Suspended Slab Stair Forms


SHEATHING
STRINGER
EDGE FORM
KICKER
A
SIDE FORM
SCAB
HORSE
A
SHORE
JOIST
CENTER SUPPORT
BRACE
BLOCK
RISER FORM
WEDGE
SILL

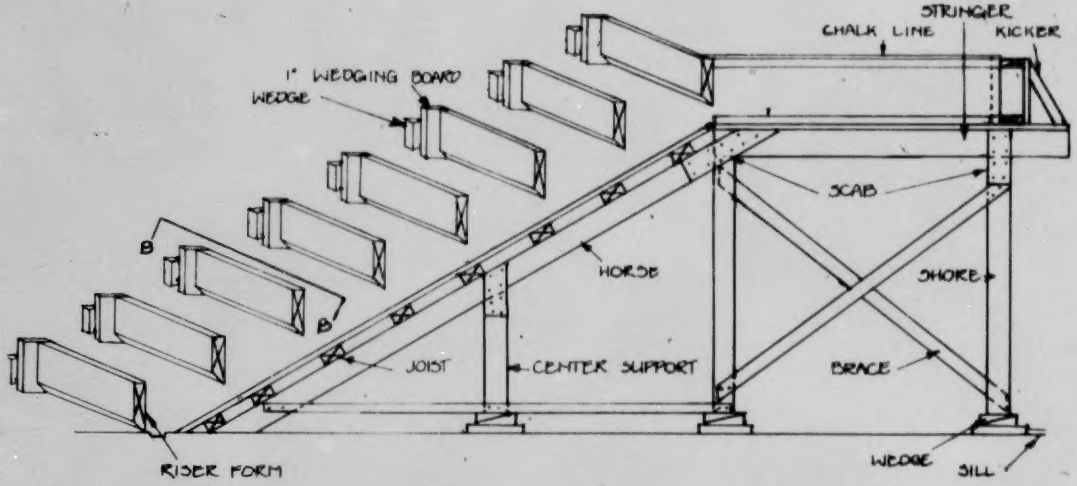

RISER FORM
BLOCK
SIDE FORM
ALIGNER
KICKER
JOIST
HORSE
SHEATHING

Section AA

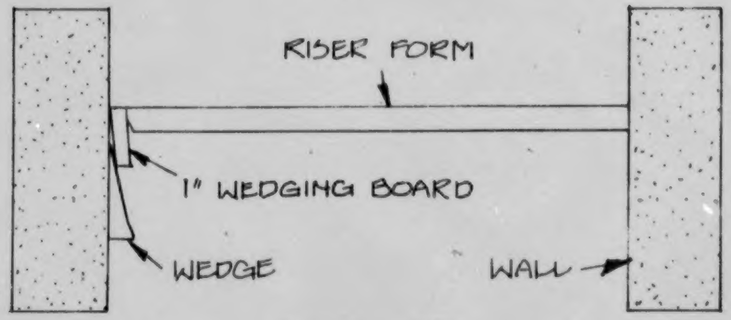
FORMS FOR STAIRS OPEN ON THE SIDES

Suspended Slab Stair Forms

(CONTINUED)

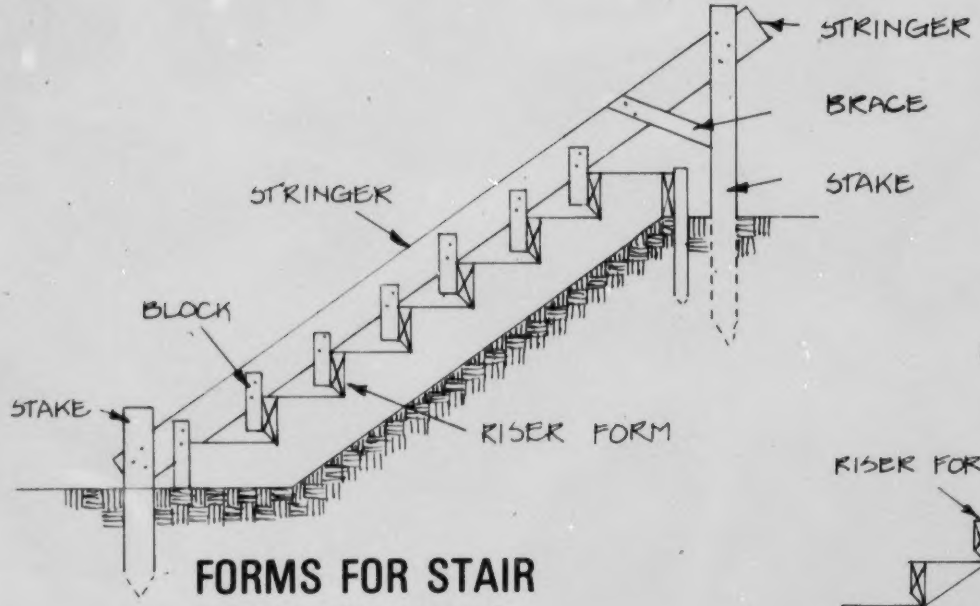

STRINGER
CHALK LINE
KICKER
1" WEDGING BOARD
WEDGE
B
B
SCAB
HORSE
SHORE
JOIST
CENTER SUPPORT
BRACE
RISER FORM
WEDGE
SILL

FORMS FOR STAIRS BETWEEN WALLS

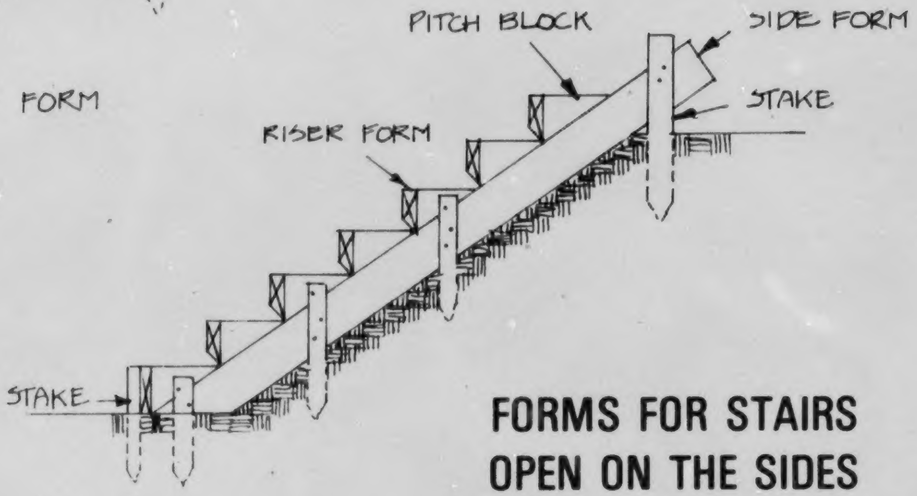

RISER FORM
1" WEDGING BOARD
WEDGE
WALL

Section BB

Earth-Supported Stair Slab Forms

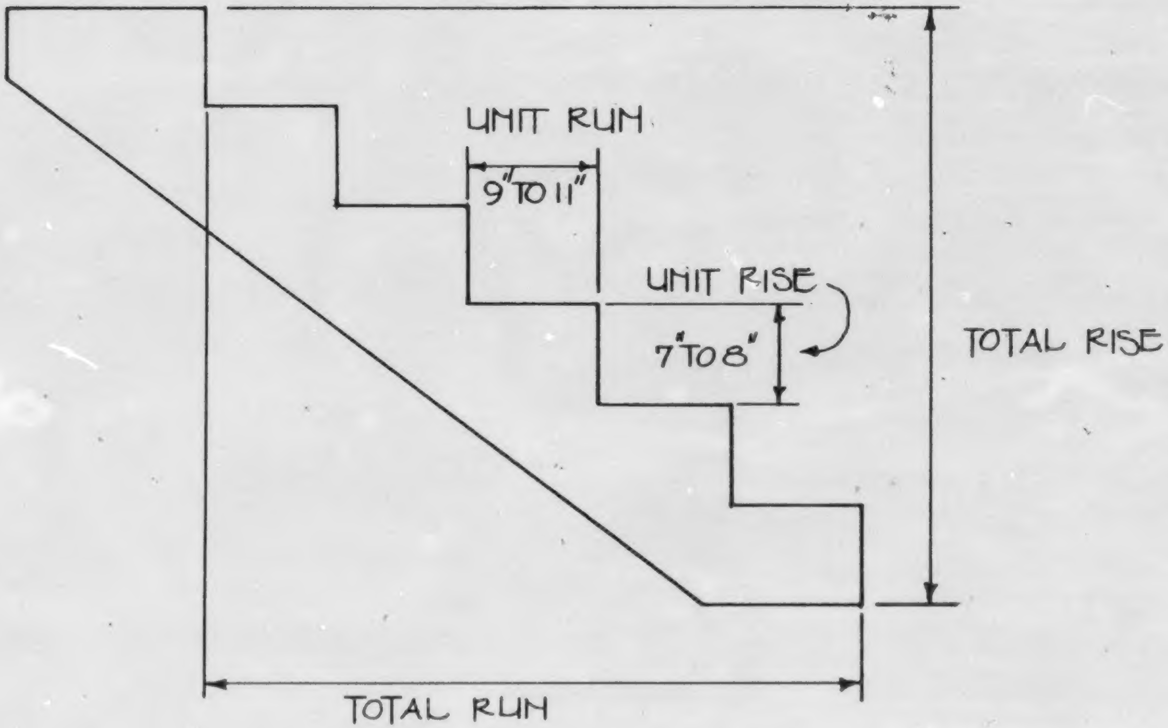

STRINGER
BRACE
STAKE
STRINGER
BLOCK
STAKE
RISER FORM

FORMS FOR STAIR BETWEEN WALLS

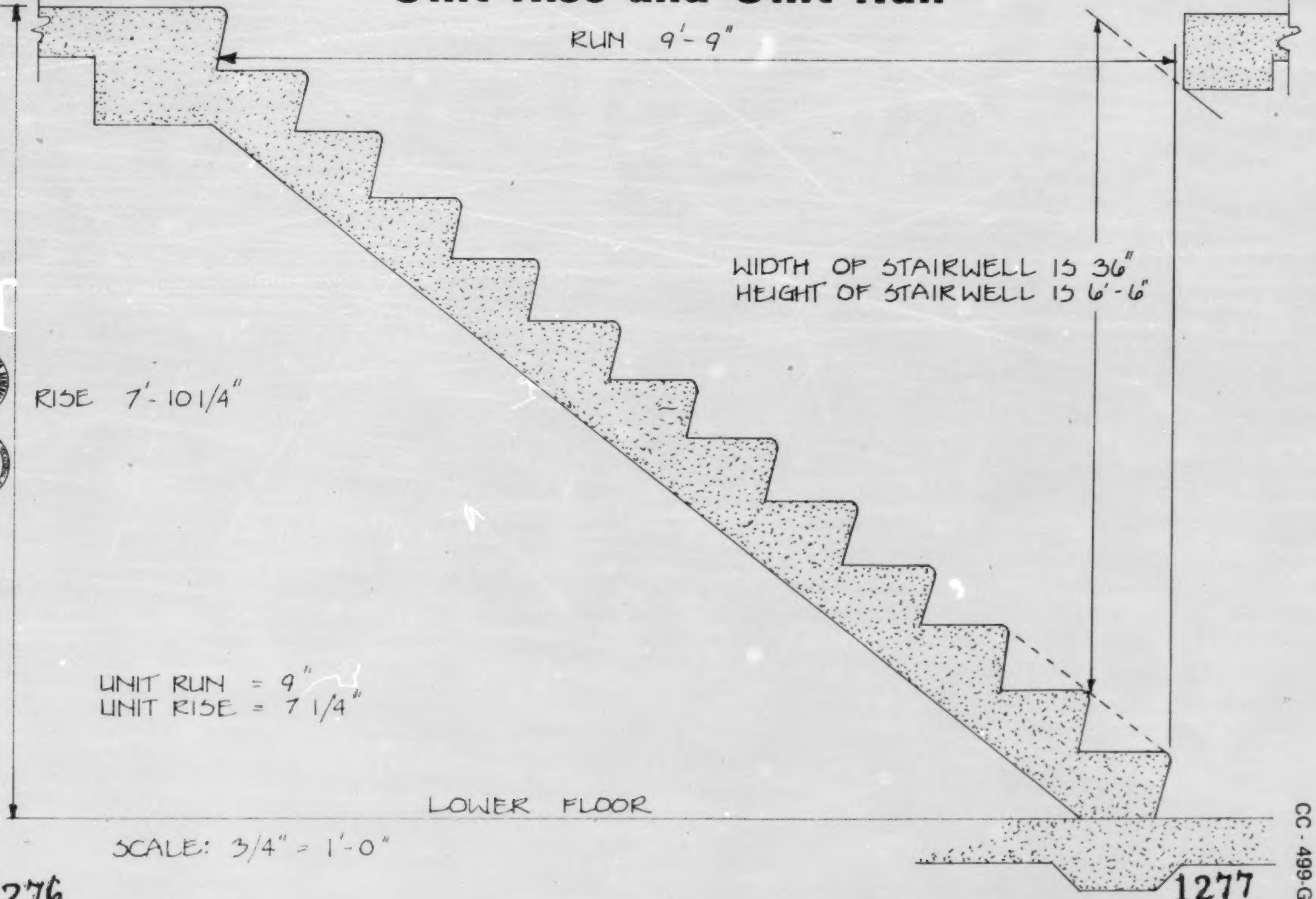

PITCH BLOCK
SIDE FORM
STAKE
RISER FORM
STAKE

FORMS FOR STAIRS OPEN ON THE SIDES

Rise and Run of Stairs


UNIT RUN
9" TO 11"
UNIT RISE
7" TO 8"
TOTAL RISE
TOTAL RUN

Unit Rise and Unit Run


RUN 9'-9"
WIDTH OF STAIRWELL IS 36"
HEIGHT OF STAIRWELL IS 6'-6"
RISE 7'-10 1/4"
UNIT RUN = 9"
UNIT RISE = 7 1/4"
LOWER FLOOR

SCALE: 3/4" = 1'-0"

STAIR FORMS
UNIT X

JOB SHEET #1--CONSTRUCT FORMS FOR SUSPENDED STAIRS

(NOTE: These forms are for stairs open at the sides.)

I. Tools and materials

A. Tools

1. Hammer, 16 oz or larger
2. Handsaw, crosscut
3. Electric handsaw
4. Level, hand
5. Builder's level
6. Framing square
7. Tape measure, 12 or 16 foot
8. Framing square gauges

B. Materials

1. Plywood for side forms and decking
2. 2 x 4's for stakes, aligners, and blocks
3. 1 x 4's for braces
4. 4 x 4's for shores, horses, joist, and stringers
5. 1 1/2" x 4" x 10" for wedges
6. 2 x 8's for risers

II. Procedure

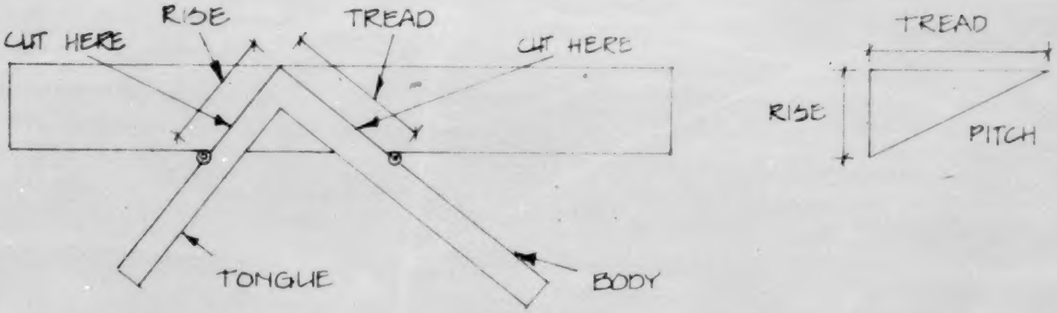
A. Make a pitch board (Figure 1)

1. Place gauges on square to correspond to rise and run of a stair unit

JOB SHEET #1

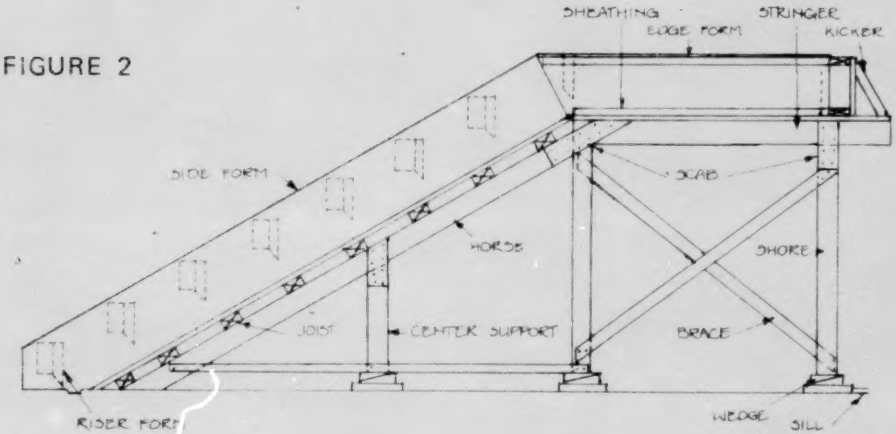
2. Place square on a thin board; mark and cut as shown in Figure 1

FIGURE 1


RISE
TREAD
CUT HERE
CUT HERE
TONGUE
BODY
TREAD
RISE
PITCH

B. Cut material to size (Figure 2)

FIGURE 2


SHEATHING
STRINGER
EDGE FORM
KICKER
SIDE FORM
SCAB
HORSE
SHORE
JOIST
CENTER SUPPORT
BRACE
RISER FORM
WEDGE
SILL

1. Obtain shore length by deducting decking, stringer, sill, and wedge thicknesses from the bottom of slab height

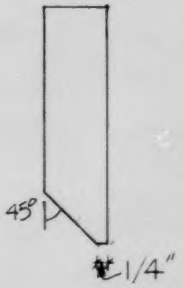
JOB SHEET #1

2. Project stringers past the platform a distance equal to the height of the edge form
3. Cut side forms to width
   a. Use the pitch board
   b. Measure the step and slab thickness on a line 90° to the pitch
   c. Add 2" to determine width at the intersection of the tread and riser
4. Frame beam sides
   a. Measure length of pitch on pitch board
   b. Multiply by the number of treads
   c. Add one foot to determine length
5. Cut joist to length by determining the width of the slab plus the height of two side forms
6. Cut edge forms the same width as the slab thickness
7. Cut horse scabs by laying pitch board on material with the pitch side flush with the bottom; cut on the tread side
8. Cut horse blocks by laying pitch board on edge of material with the pitch side flush with the bottom; cut on the riser side
9. Size riser forms (Figure 3)

   (NOTE: When pouring a rough stair, it is not necessary to cut the bottom of the riser form at a 45° angle.)

   a. Cut to riser height
   b. Cut to stair width
   c. Cut 45° bevel on bottom edge

FIGURE 3

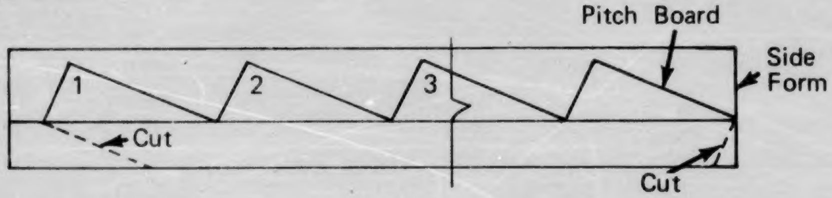


JOB SHEET #1

C. Lay out beam sides (Figure 4)

(NOTE: Two beam sides are needed, one right hand and one left hand.)

FIGURE 4

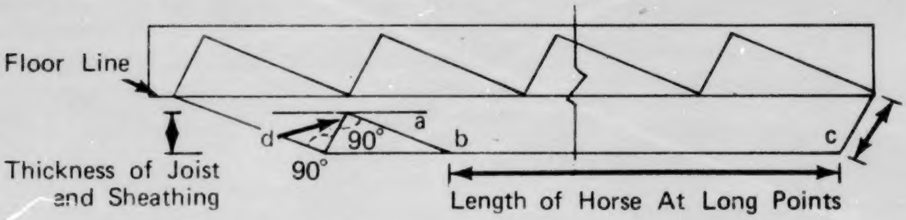

Pitch Board
Side Form
1
2
3
Cut
Cut

1. Scribe a pencil line on the form equal to the thickness of the slab
2. Lay pitch side of pitch board on line and mark tread and riser position #1 as illustrated in Figure 4
3. Move pitch board to position #2 and mark tread and riser

   (NOTE: Intersect all lines accurately. Use sharp pencil.)
4. Repeat step 3 to lay out step #3 and all other steps in the flight
5. Lay out and cut ears as shown by dotted lines in Figure 4

D. Lay out and cut horses; determine length (Figure 5)

FIGURE 5


Floor Line
Thickness of Joist and Sheathing
d
90°
a
b
90°
c
Length of Horse At Long Points

1. Scribe a line equal to the thickness of the joist and sheathing, establishing line a
2. Square from intersection of floor line and bottom of side form to intersect with line a
3. Square from this line to make point b intersect with the bottom edge of the form

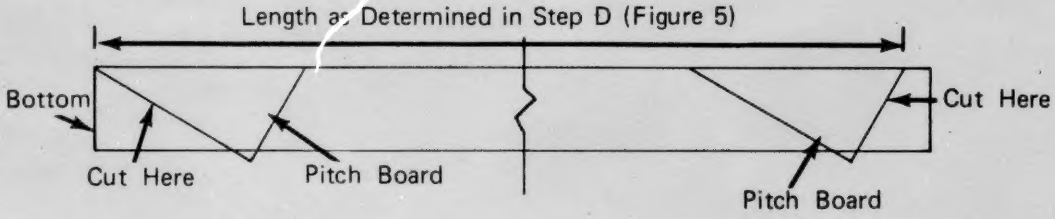
JOB SHEET #1

4. Measure from point b to point c to determine length of horse
5. Lay out this length on horse

   (NOTE: These are the long points of the horse.)

6. Lay out top and bottom cuts (Figure 6)

FIGURE 6

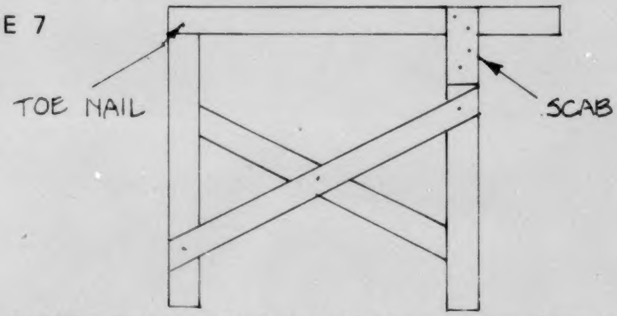

Length as Determined in Step D (Figure 5)
Bottom
Cut Here
Pitch Board
Pitch Board
Cut Here

7. Cut on lines as shown in Figure 6

E. Erect shores and stringers

1. Nail two shores to each stringer and X brace (Figure 7)

FIGURE 7


TOE NAIL
SCAB

(NOTE: Place a block the thickness of the shore between braces to nail crossing point.)

2. Lay sills on floor at location of shores
3. Tack wedges to sill at shore locations
4. Stand end shores upright; tack spacer board across the top; X-brace
5. Install intermediate shore bents

F. Install horses

1. Tack top of the horse to shore

   (NOTE: Measure length of line d in Figure 5 from top of decking to determine location.)

JOB SHEET #1

2. Nail cleat across horse, stringer, and shore
3. Repeat steps 1 and 2 to complete erection

G. Nail joist to horses

(NOTE: Space as needed and allow a uniform overhang on each side.)

H. Nail decking to joist and stringers

(NOTE: Use a minimum of nails to hold decking in place.)

I. Lay out sides of stair and landing

(NOTE: Drop a plumb bob from edge of stair hole to establish lines.)

J. Install side forms and edge forms

(NOTE: Form oil must be applied before rebars are installed.)

1. Nail a continuous kicker to deck

   (NOTE: Kicker will be placed the thickness of the riser forms back of layout lines.)

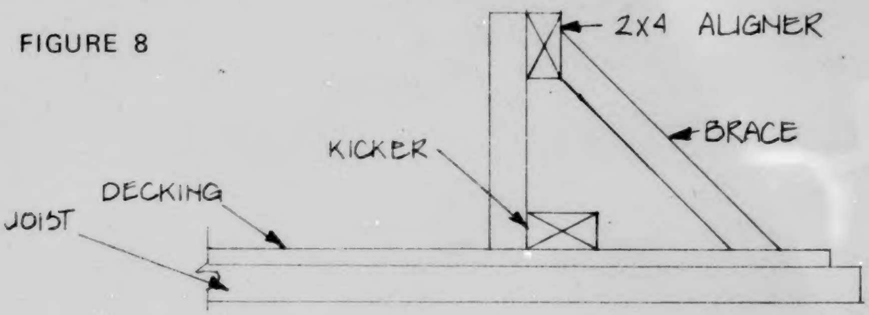
2. Stand forms upright on the deck and nail to the kicker

K. Install riser form

(NOTE: Hold riser form on riser layout line and nail through form side with duplex nails.)

L. Install aligner and brace beam sides (Figure 8)

FIGURE 8



M. Install blocks at risers

(NOTE: Blocks are not needed if the tread form material is thick, solid lumber.)

STAIR FORMS
UNIT X

JOB SHEET #2--CONSTRUCT FORMS FOR STAIRS ON EARTH

I. Tools and materials

A. Tools

1. Hammer, 16 oz or larger
2. Handsaw, crosscut
3. Electric handsaw
4. Sledge
5. Framing square gauges
6. Level, hand
7. Builder's level
8. Framing square
9. Tape measure, 12 or 16 foot

B. Materials

1. Plywood forms
2. 2 x 4's for stakes
3. 2 x 4's for aligners
4. 2 x 8's for risers
5. 2 x 4's for blocks
6. 1 x 4's for braces

II. Procedure

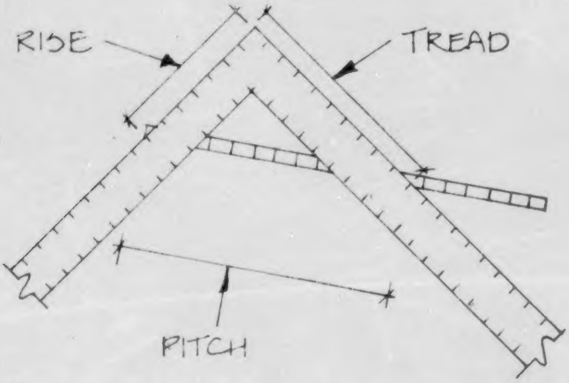
A. Determine width and length of side form (Figure 1)

1. Form width will be the slab thickness plus the riser height and two inches

JOB SHEET #2

2. Form length will be the length of the pitch of one step times the number of steps in the flight; add one foot for overhang

FIGURE 1

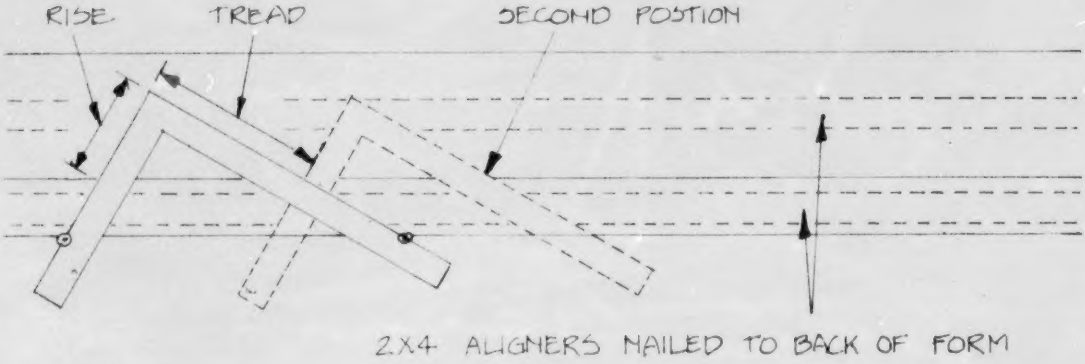

RISE
TREAD
PITCH

B. Cut form side to size

(NOTE: Form sides may also be made from 1 x 6 or wider boards cleated together.)

C. Lay out side forms (Figure 2)

FIGURE 2


RISE
TREAD
SECOND POSTION
2X4 ALIGNERS NAILED TO BACK OF FORM

1. Gauge a line equal to the slab thickness on the form side

2. Lay framing square on form with riser height and tread width on slab line

JOB SHEET #2

3. Attach framing square gauges

4. Mark tread and riser on form

5. Move square to next step and lay out tread and riser

   (NOTE: Use a sharp pencil and follow line intersections accurately.)

6. Repeat step 5 to complete layout

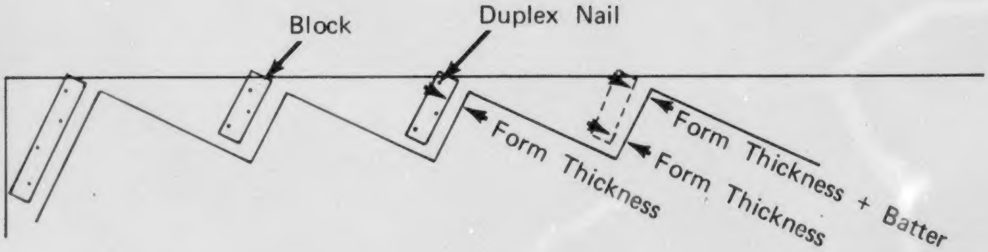
7. Lay out opposite side form following steps 1 to 6

   (NOTE: There will be two form sides. The forms will be laid out for right and left hand sides.)

8. Nail aligners to form sides

D. Nail riser support blocks to form sides (Figure 3)

FIGURE 3


Block
Duplex Nail
Form Thickness
Form Thickness
Form Thickness + Batter

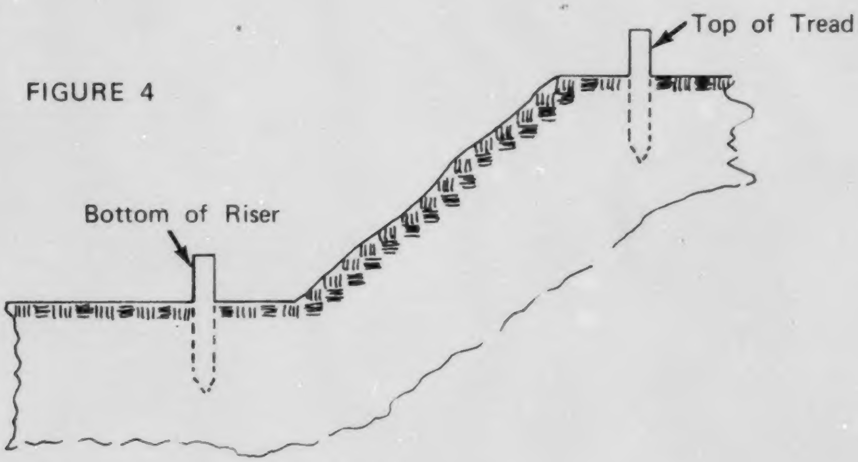
(NOTE: For battered riser, add batter dimension to tread length as shown on right hand riser.)

JOB SHEET #2

E. Set grade stakes at top and bottom of flight (Figure 4)

(NOTE: Use builder's level to establish grade from bench mark.)

FIGURE 4



F. Drive side form support stakes

(NOTE: Allow for sheathing and aligners when driving stakes.)

G. Set form sides

1. Set form side against stakes
2. Level over from bottom grade stake to bottom of first riser; adjust form and nail to stake
3. Level over from top grade stake to top tread line; adjust form and nail to stake
4. Nail form to intermediate stakes
5. Repeat steps 1 to 4 to continue erection

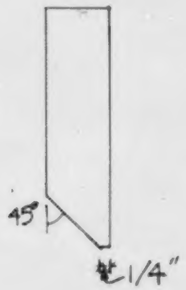
H. Size riser forms (Figure 5)

1. Cut form material to length
2. Cut riser forms to width

JOB SHEET #2

3. Cut bottom of riser form to 45° angle

FIGURE 5



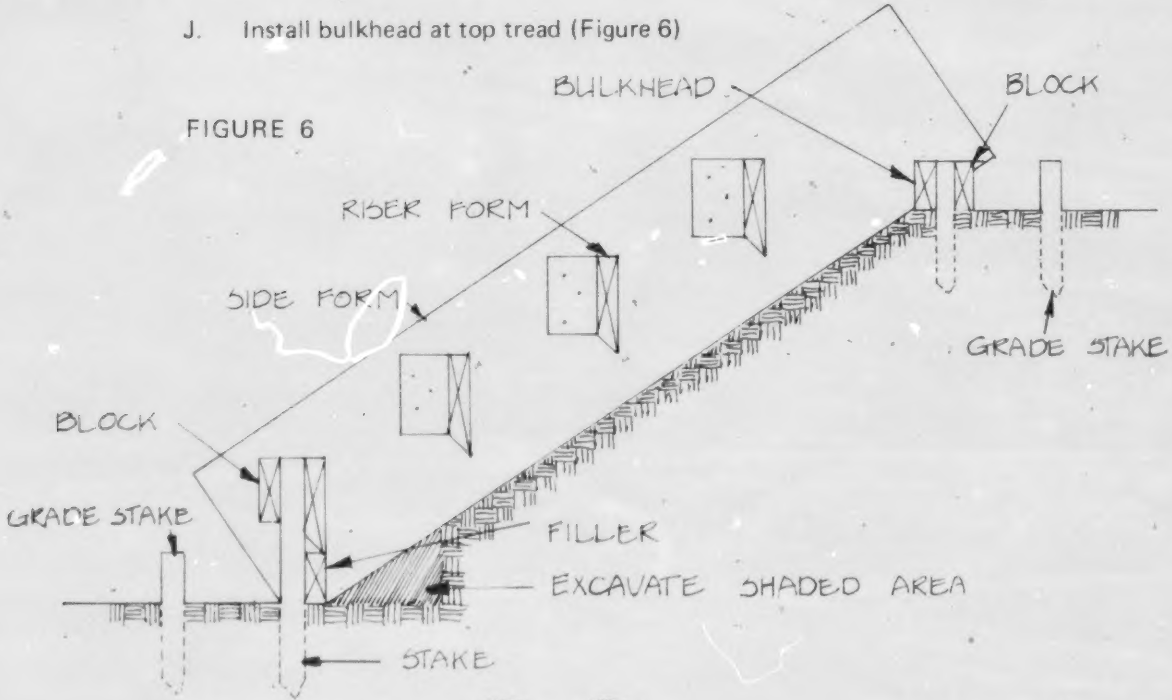
I. Install riser forms

1. Place riser form in position with top of form flush with tread line and against block
2. Nail riser forms from back side of side form using duplex nails
3. Repeat steps 1 and 2 to continue installation

   (NOTE: If bottom landing slab is not poured at this time, a filler piece the thickness of the slab will have to be installed under the bottom riser form.)

J. Install bulkhead at top tread (Figure 6)

FIGURE 6

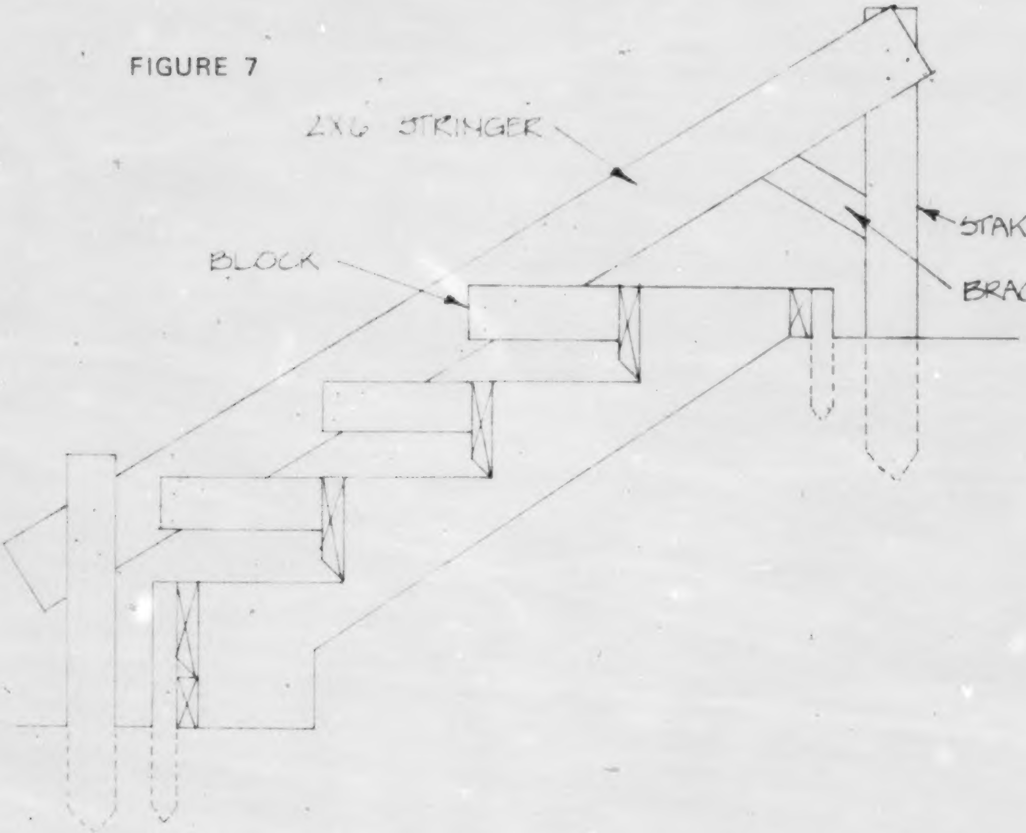

BULKHEAD
BLOCK
RISER FORM
SIDE FORM
GRADE STAKE
BLOCK
GRADE STAKE
FILLER
EXCAVATE SHADED AREA
STAKE

JOB SHEET #2

K. Install center support (Figure 7)

(NOTE: Center supports are not needed on narrow flights of stairs.)

FIGURE 7


2X6 STRINGER
BLOCK
STAKE
BRACE

(NOTE: Stringer should be at least one inch above the riser to allow work room.)

STAIR FORMS
UNIT X

JOB SHEET #3--CONSTRUCT FORMS FOR SHORT FLIGHTS OF STAIRS

I. Tools and materials

  A. Tools

    1. Hammer, 16 oz or larger
    2. Handsaw, crosscut
    3. Electric handsaw
    4. Sledge
    5. Framing square gauges
    6. Framing square
    7. Level, hand
    8. Electric drill and bits

  B. Materials

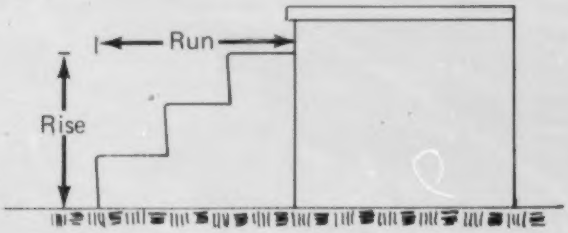
    1. Plywood side forms
    2. 2 x 4's for stakes and stiffener
    3. 2 x 8's for risers
    4. 1 x 4's for braces
    5. 1/2" conduit for spreaders
    6. Allthread or smooth rod for ties

II. Procedure

  A. Determine width and length of side form (Figure 1)

  (NOTE: Forms should be at least 4" wider than rise and run.)

FIGURE 1



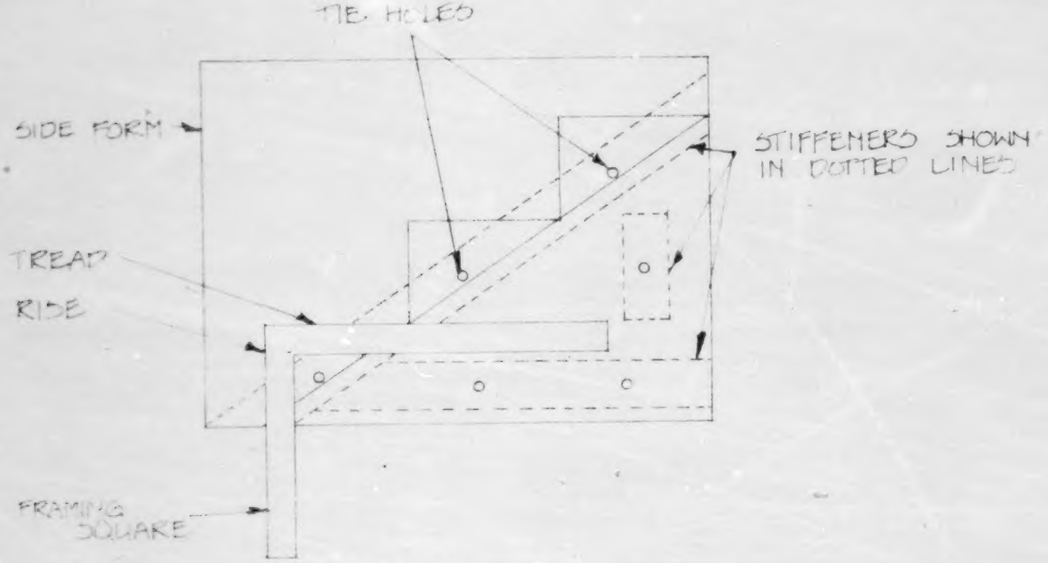
JOB SHEET #3

B. Cut forms to size

C. Lay out steps on both forms (Figure 2)

(NOTE: Make a right and left hand layout.)

FIGURE 2


TIE HOLES
SIDE FORM
STIFFENERS SHOWN IN DOTTED LINES
TREAD
RISE
FRAMING SQUARE

D. Drill tie holes in pattern shown in Figure 2

(NOTE: Place forms back to back and drill both at the same time.)

E. Attach stiffeners to back side of forms centered on tie holes and drill tie holes in stiffeners

F. Cut spreaders and ties to length

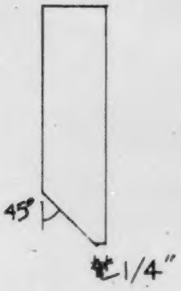
1. Spreaders shall be as long as the stair is wide
2. Cut threaded rod (allthread) the width of the stairs plus two form thicknesses and lengths for nuts and washers on each end

   (NOTE: Add one inch for tie projection.)

JOB SHEET #3

G. Size riser forms (Figure 3)

FIGURE 3



1. Lay out batter of riser on side form to determine exact width
2. Cut riser form to width
3. Cut riser form to length

   (NOTE: Riser form length will be the same as the stair width.)

4. Cut 45° angle on face of tread (Figure 3)

H. Assemble side forms

1. Stand side forms on level surface
2. Place ties through spacer and holes in both forms and secure with nut and washer

   (NOTE: One nut and washer should be placed on the allthread rod before it is installed.)

3. Snug up nuts to hold forms together

I. Set form in pour location

(NOTE: Check for level across top of riser form and plumb side forms.)

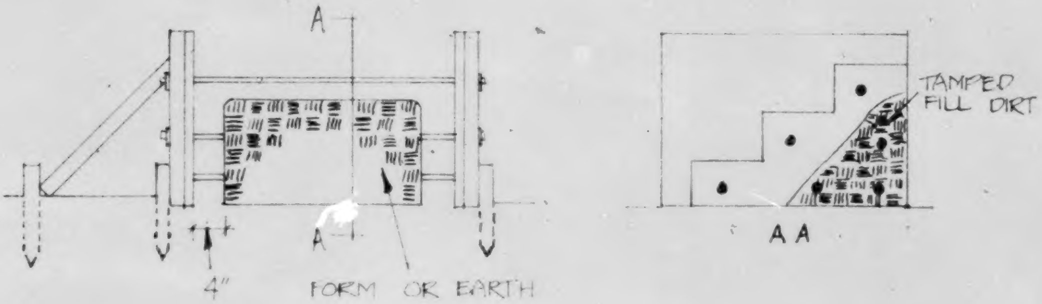
1. Drive stakes at outside of form sides
2. Raise to level position both directions and nail to stakes

JOB SHEET #3

J. Place fill dirt or form under slab (Figure 4)

(NOTE: If a form is used, it should be set before the side forms are set. Steps should be doweled at the top and rest on a footing.)

FIGURE 4


A
A
4"
FORM OR EARTH
TAMPED FILL DIRT
A A

K. Place brace as shown in Figure 4

(NOTE: Very little bracing is needed on this type of form. This type of form may be used in many situations.)

STAIR FORMS
UNIT X

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. Terms and definitions are continued on the next page.

_____a. Piece of wood or other material that directs, resists, or supports weight or pressure

_____b. Beveled piece of wood or metal placed in a form where future pours occur

_____c. Piece of wood or metal secured across a splice to strengthen and hold the two pieces together

_____d. Wide boards, plywood, or metal that make up the horizontal face of the form

_____e. Small board or steel bar sharpened at one end and driven into the ground to support the form

_____f. Paraffin oil or a manufactured product used on a form to prevent adhesion of the concrete to the form

_____g. Inclined supporting member of a stair form or stair

_____h. Platform between flights of stairs

_____i. Distance from the floor to the top of a landing or to the floor above

_____j. Vertical part of a stair step

_____k. Horizontal distance between the first riser and the face of the platform or stair opening above

_____l. Horizontal part of a stair step

1. Tread
2. Stair rise
3. Form oil
4. Riser
5. Horse
6. Key
7. Stake
8. Scab
9. Brace
10. Decking
11. Landing
12. Stair run

______m. Wood block used to lay out or support treads and risers

______n. Forward inclination of a riser

______o. Framework designed to carry lateral as well as vertical loads

______p. Compartment extending vertically through a structure and in which stairs are placed

______q. Device attached to a framing square to secure accuracy when laying out material

______r. In construction, a piece of wood or other material secured to a fixed object or wedged against an object to support weight or pressure

______s. Vertical board placed in a form to cut off the concrete pour

______t. Piece of wood or metal used to hold the sides of a form apart until the concrete is poured

13. Stairwell
14. Batter
15. Spreader
16. Framing square gauge
17. Bulkhead
18. Bent
19. Pitch board
20. Kicker

2. Identify the parts of a stair form by placing the correct numbers in the blanks below.

______a. Horse

______b. Joist

______c. Block

______d. Riser form

______e. Side form

______f. Sheathing

______g. Edge form

______h. Brace

______i. Stringer

______j. Shore

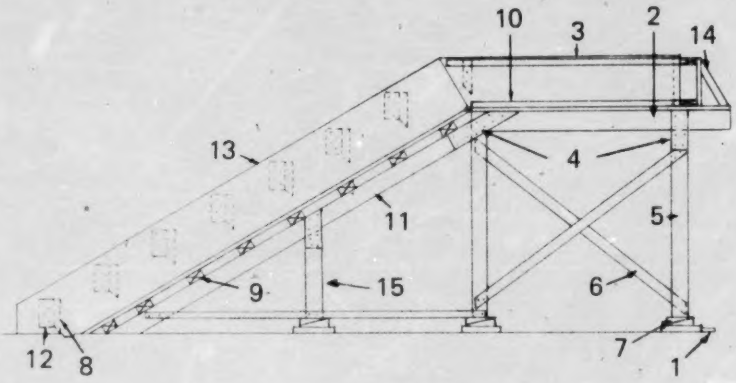
______k. Wedge

______l. Sill

______m. Scab

______n. Kicker

______o. Center support



3. Name types of concrete stairs.

a. ______________________________

b. ______________________________

4. Identify the stair plan shapes by writing the correct numbers in the blanks.

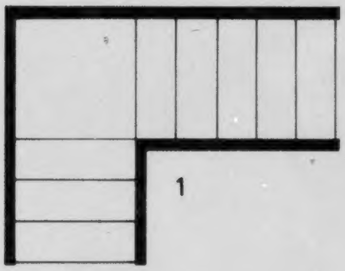
______a. Straight flight

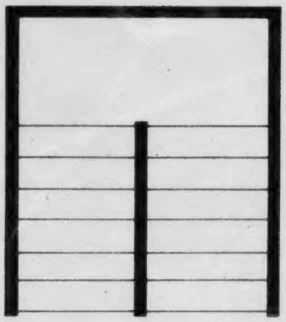
______b. Straight flight with landing

______c. 90° flights with landing

______d. 90° flights with winders

______e. 180° flights with landing


1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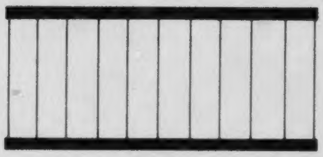
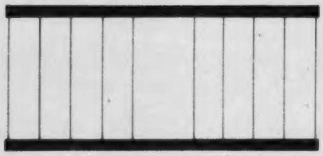
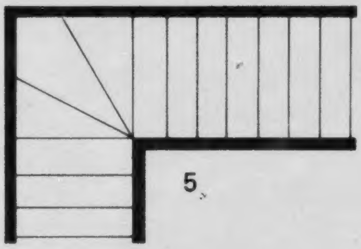

3


4

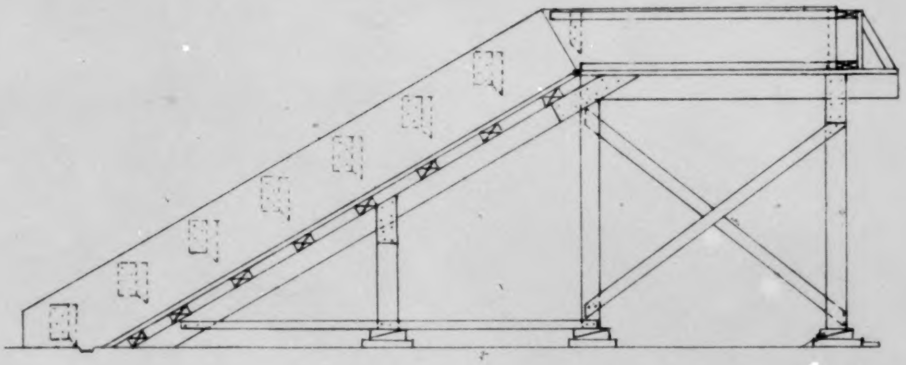

5

5. Name types of stair slabs.

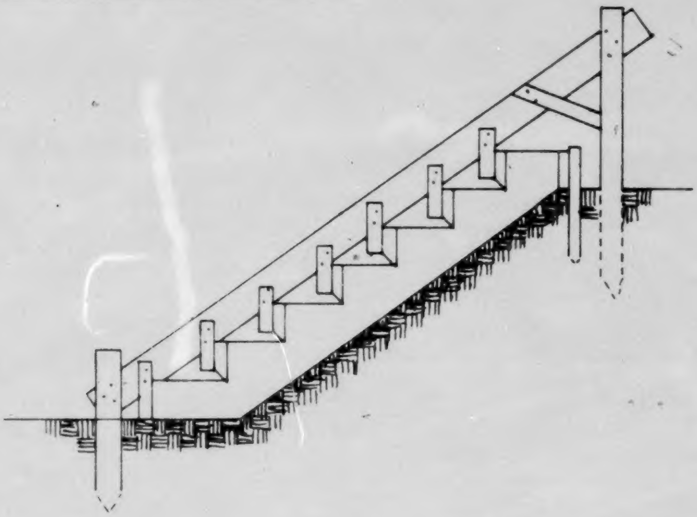
a. ______________________________

b. ______________________________

6. Identify details of stair forms by writing the correct names in the blanks provided.



a. ____________________



b. ____________________

7. State the rule of thumb for unit run and unit rise.

____

____

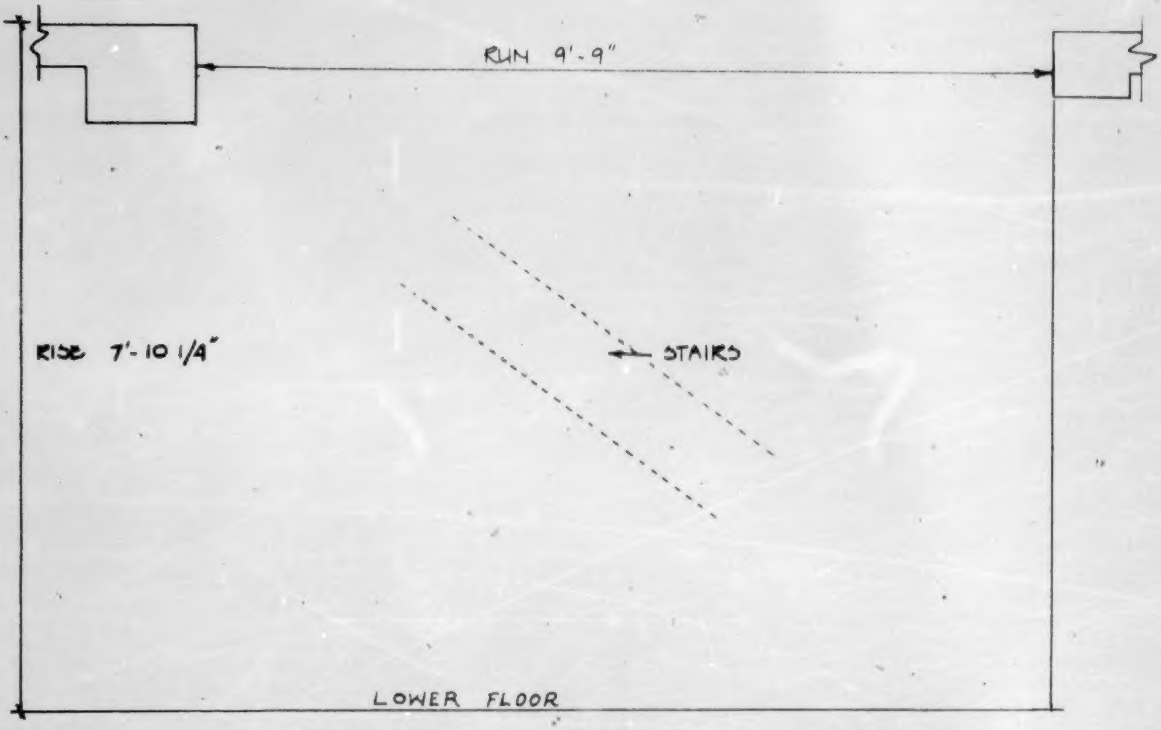
____

____

8. Calculate the number of risers and the number of treads for the stair pictured below.

______a. Risers

______b. Treads



9. Demonstrate the ability to:

   a. Construct forms for suspended stairs.

   b. Construct forms for stairs on earth.

   c. Construct forms for short flights of stairs.

   (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

STAIR FORMS
UNIT X

ANSWERS TO TEST

1. a. 9
b. 6
c. 8
d. 10
e. 7
f. 3
g. 5
h. 11
i. 2
j. 4
k. 12
l. 1
m. 19
n. 14
o. 18
p. 13
q. 16
r. 20
s. 17
t. 15

2. a. 11
b. 9
c. 12
d. 8
e. 13
f. 10
g. 3
h. 6
i. 2
j. 5
k. 7
l. 1
m. 4
n. 14
o. 15

3. a. Rough
b. Finished

4. a. 3
b. 4
c. 1
d. 5
e. 2

5. a. Suspended
   b. Earth-supported
6. a. Suspended
   b. Earth-supported
7. Total of one riser and one tread should not be less than 16" or more than 18"
   a. Unit rise should be 7" - 8"
   b. Unit run should be 9" - 11"
8. a. 13
   b. 13
9. Performance skills evaluated to the satisfaction of the instructor

BRIDGE DECK FORMS
UNIT XI

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the parts of a bridge deck form, name methods of supporting deck forms, and name types of bridges using reinforced concrete slabs. The student should also be able to construct forms for a bridge deck. This knowledge will be evidenced by completion of the job sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with bridge deck forms to the correct definitions.
2. Identify the parts of a bridge deck form.
3. Name methods of supporting deck forms.
4. Name types of bridges that use reinforced concrete slabs.
5. Demonstrate the ability to construct forms for a bridge deck.

BRIDGE DECK FORMS
UNIT XI

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Demonstrate and discuss procedures outlined in job sheet.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Parts of a Bridge Deck Form

      2. TM 2--Methods of Supporting Deck Forms

      3. TM 3--Methods of Supporting Deck Forms (Continued)

      4. TM 4--Types of Bridges That Use Reinforced Concrete Slabs

      5. TM 5--Types of Bridges That Use Reinforced Concrete Slabs (Continued)

   D. Job Sheet #1--Construct Forms for a Bridge Deck

   E. Test

   F. Answers to test

III. Unit references:

   A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

   B. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

BRIDGE DECK FORMS
UNIT XI

INFORMATION SHEET

I. Terms and definitions

A. Bracket--Braced frame used to support deck overhang

B. Coil bolt--Bolt with coarse threads made to fit the helix coil of coil ties and anchors

C. Needle beam--Horizontal support member set on shores or hung

D. Monolithic pour--Continuous mass of concrete cast as a single unit

E. Brace--Piece of wood or other material that directs, resists, or supports weight or pressure

F. Scab--Piece of wood or metal secured across a joint to strengthen and hold the two pieces together

G. Bulkhead--Board placed in a form to cut off the concrete pour

H. Sheathing--Wide boards, plywood, or metal that make up the face of the form

I. Form oil--Paraffin oil or a manufactured product used on a form to prevent adhesion of the concrete to the form

J. Edge form--Low form placed at the perimeter of a slab

K. Expansion joint--Preformed piece of fibrous or asphaltic material used to separate units of concrete to prevent cracking due to expansion and contraction

L. Slab--Section of concrete larger in its horizontal dimensions than in its thickness

M. Deck--Horizontal sheathing that supports the wet concrete

N. Expansion dam--Part of the bridge that lets it expand and contract with temperature change

O. Scuppers--Steel catch basin located on the low point of the bridge slab which is designed to drain water off the bridge slab

P. Curb--Raised edge designed to keep cars on roadway

Q. Median barrier--Wall projecting from the deck dividing opposite lanes of traffic

INFORMATION SHEET

R. Backwall--Wall that receives the roadway and connects it to the bridge slab through the expansion joint

S. Diaphragm--Steel spacer beams at intervals on long girders

(NOTE: The diaphragm is perpendicular to the long girders and also supports the concrete at construction joints in the slab.)

T. Screed--Strip of wood or metal used as a guide for leveling or grading a concrete slab

U. Drip groove--Groove in any soffit where the undersurface is exposed to weather, designed to keep water from running back on the soffit

V. Parapet--Longitudinal walk above the surface of the deck which serves as a barrier throughout the length of a bridge

II. Parts of a bridge deck form (Transparency 1)

A. Brace

B. Edge form (parapet)

C. Bracket (job-built or manufactured)

D. Decking

E. Wood filler

F. Stringer

G. Joist

H. Duplex nails

I. Supports

J. Cleat

K. Steel hangers or allthread rod (with speed thread)

L. Washers and nuts

M. Chamfer

(NOTE: This refers to a beveled corner which is formed in concrete work by placing a three-cornered piece of wood, cant strip or skew back, in the form center.)

N. Drip groove

(NOTE: This is a notch in the concrete to keep water off beams.)

INFORMATION SHEET

III. Methods of supporting deck forms (Transparencies 2 and 3)

  A. Bracket and hanger

  B. Needle beam

  C. Leg supports

IV. Types of bridges that use reinforced concrete slabs (Transparencies 4 and 5)

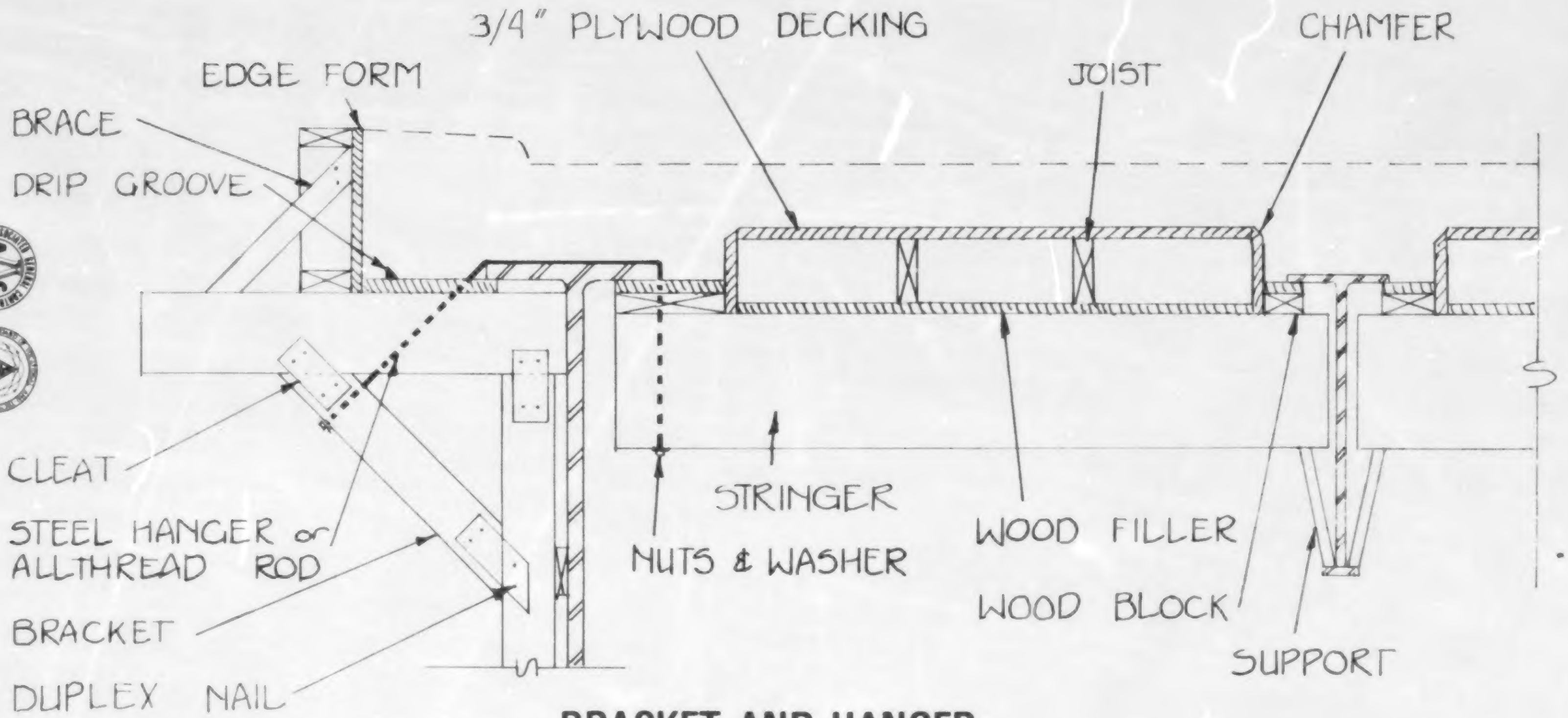
  A. Reinforced concrete slab

  B. Steel I beam

  C. Reinforced concrete T beam

  D. Precast concrete beam

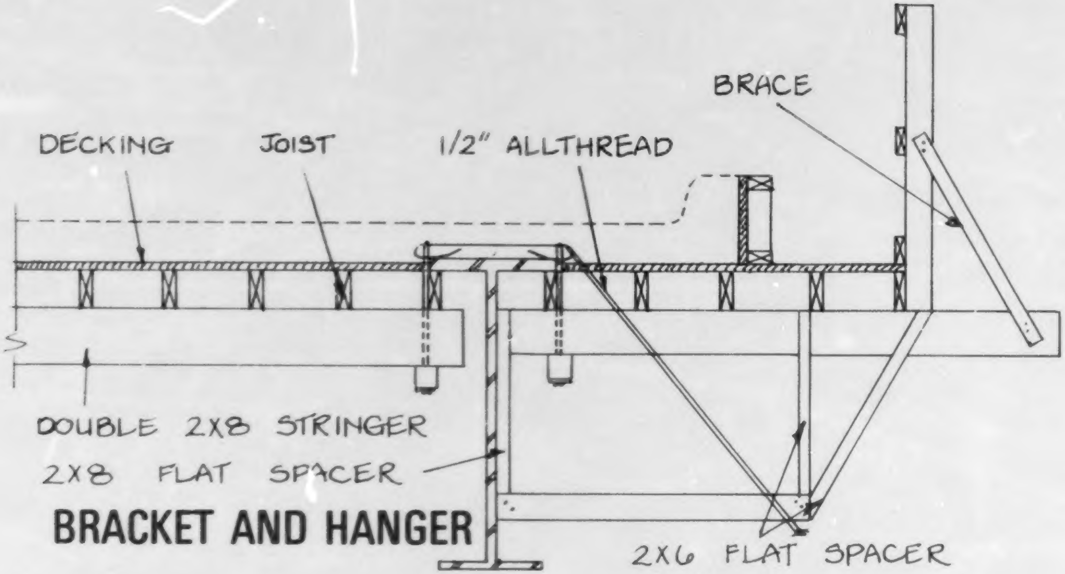
Parts of a Bridge Deck Form


3/4" PLYWOOD DECKING
EDGE FORM
JOIST
CHAMFER
BRACE
DRIP GROOVE
CLEAT
STEEL HANGER or ALLTHREAD ROD
BRACKET
DUPLEX NAIL
STRINGER
NUTS & WASHER
WOOD FILLER
WOOD BLOCK
SUPPORT

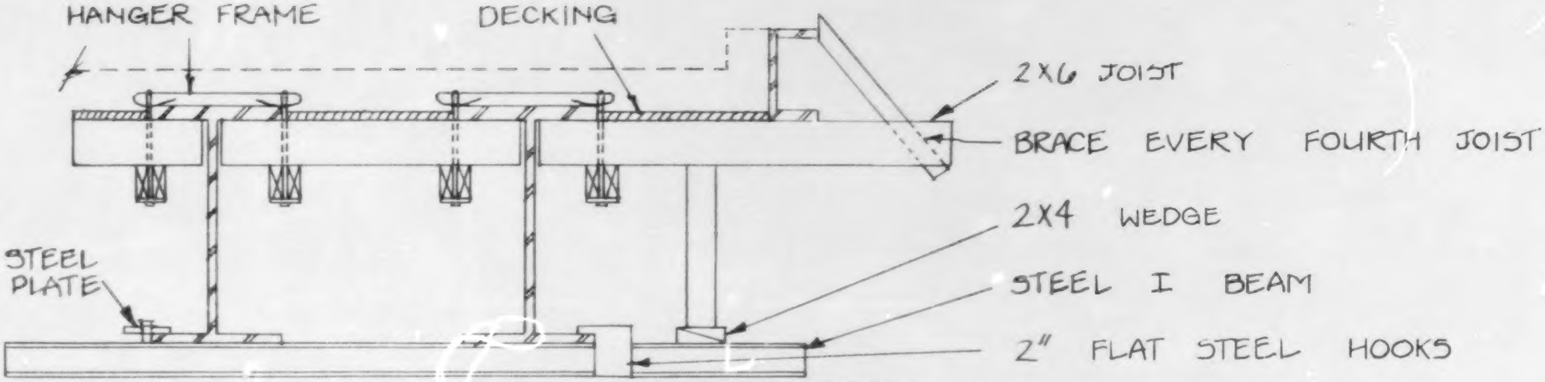
BRACKET AND HANGER

SCALE: 1" = 1'

Methods of Supporting Deck Forms


BRACE
DECKING
JOIST
1/2" ALLTHREAD
DOUBLE 2X8 STRINGER
2X8 FLAT SPACER
2X6 FLAT SPACER

BRACKET AND HANGER

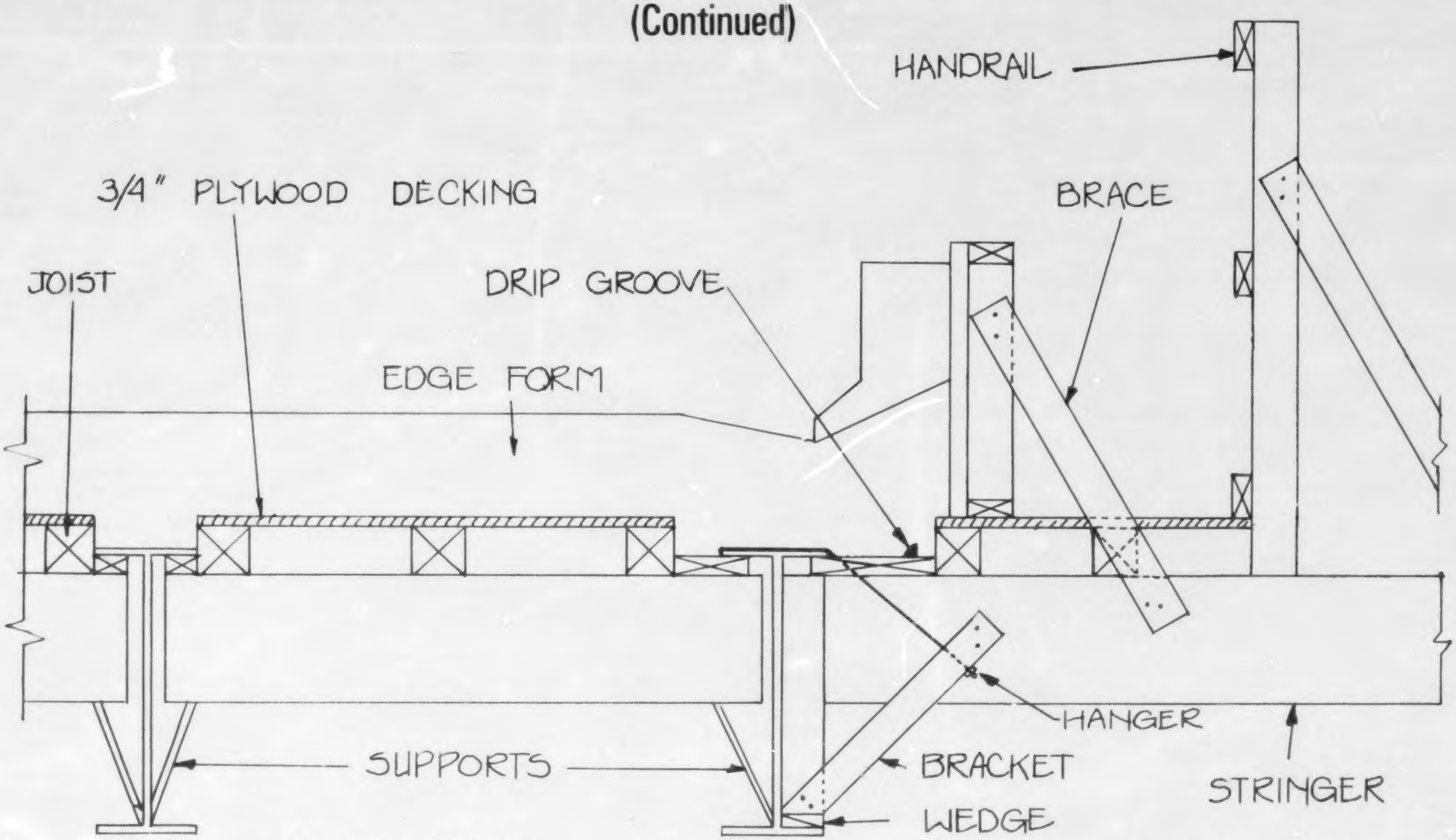

HANGER FRAME
DECKING
2X6 JOIST
BRACE EVERY FOURTH JOIST
2X4 WEDGE
STEEL PLATE
STEEL I BEAM
2" FLAT STEEL HOOKS

NEEDLE BEAM

SCALE ½" = 1'-0"

Methods of Supporting Deck Forms

(Continued)


HANDRAIL
3/4" PLYWOOD DECKING
BRACE
JOIST
DRIP GROOVE
EDGE FORM
HANGER
SUPPORTS
BRACKET
STRINGER
WEDGE

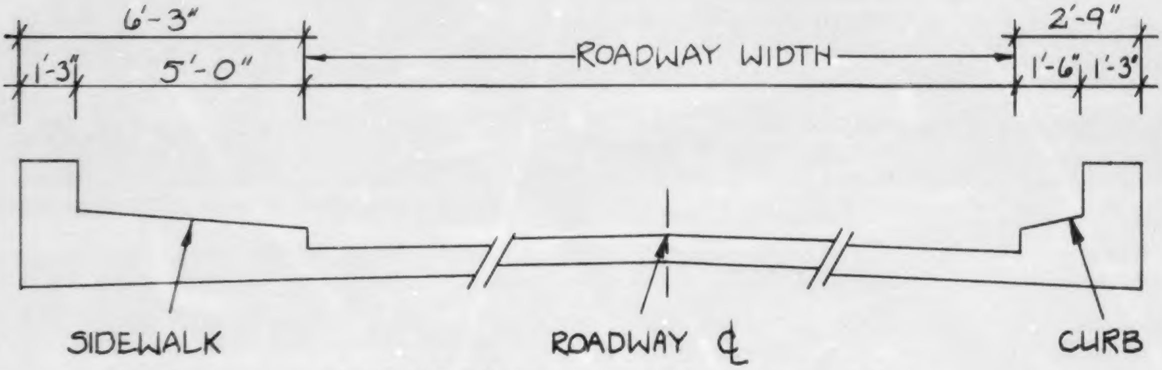
LEG SUPPORTS

SCALE: 1" = 1'

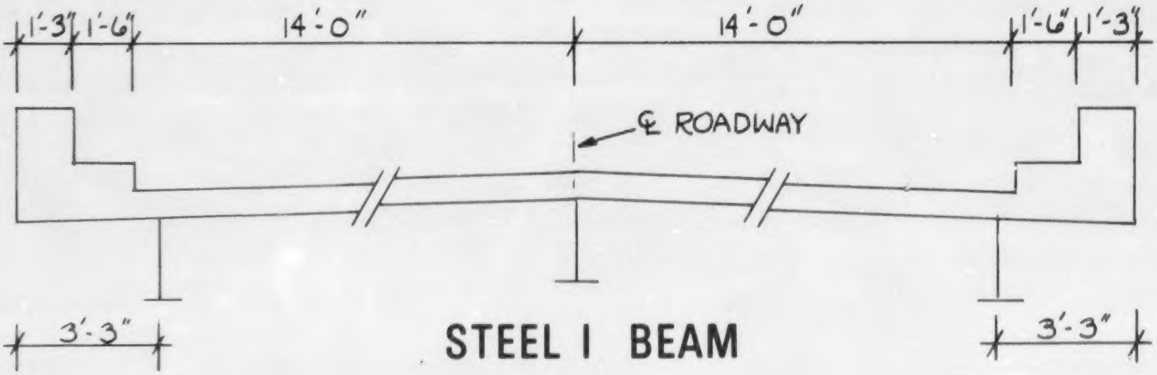
1310

1311

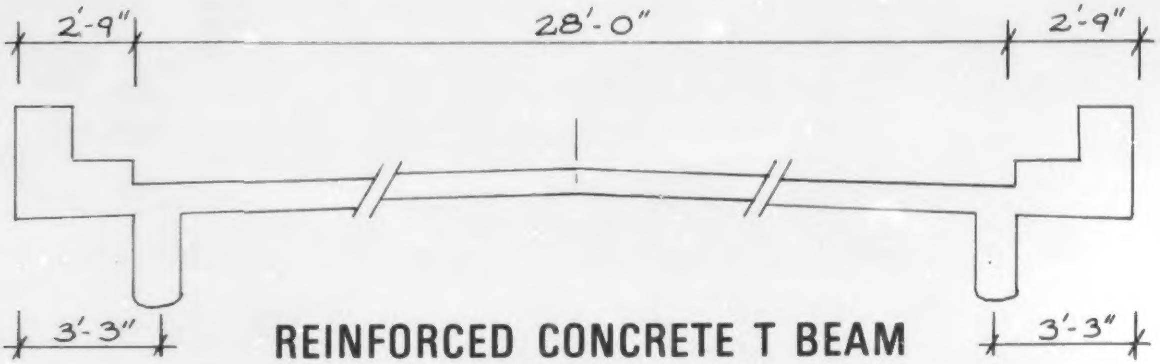
Types of Bridges That Use Reinforced Concrete Slabs


6'-3"
1'-3"
5'-0"
ROADWAY WIDTH
2'-9"
1'-6"
1'-3"
SIDEWALK
ROADWAY ℄
CURB

REINFORCED CONCRETE SLAB


1'-3"
1'-6"
14'-0"
14'-0"
1'-6"
1'-3"
℄ ROADWAY
3'-3"
3'-3"

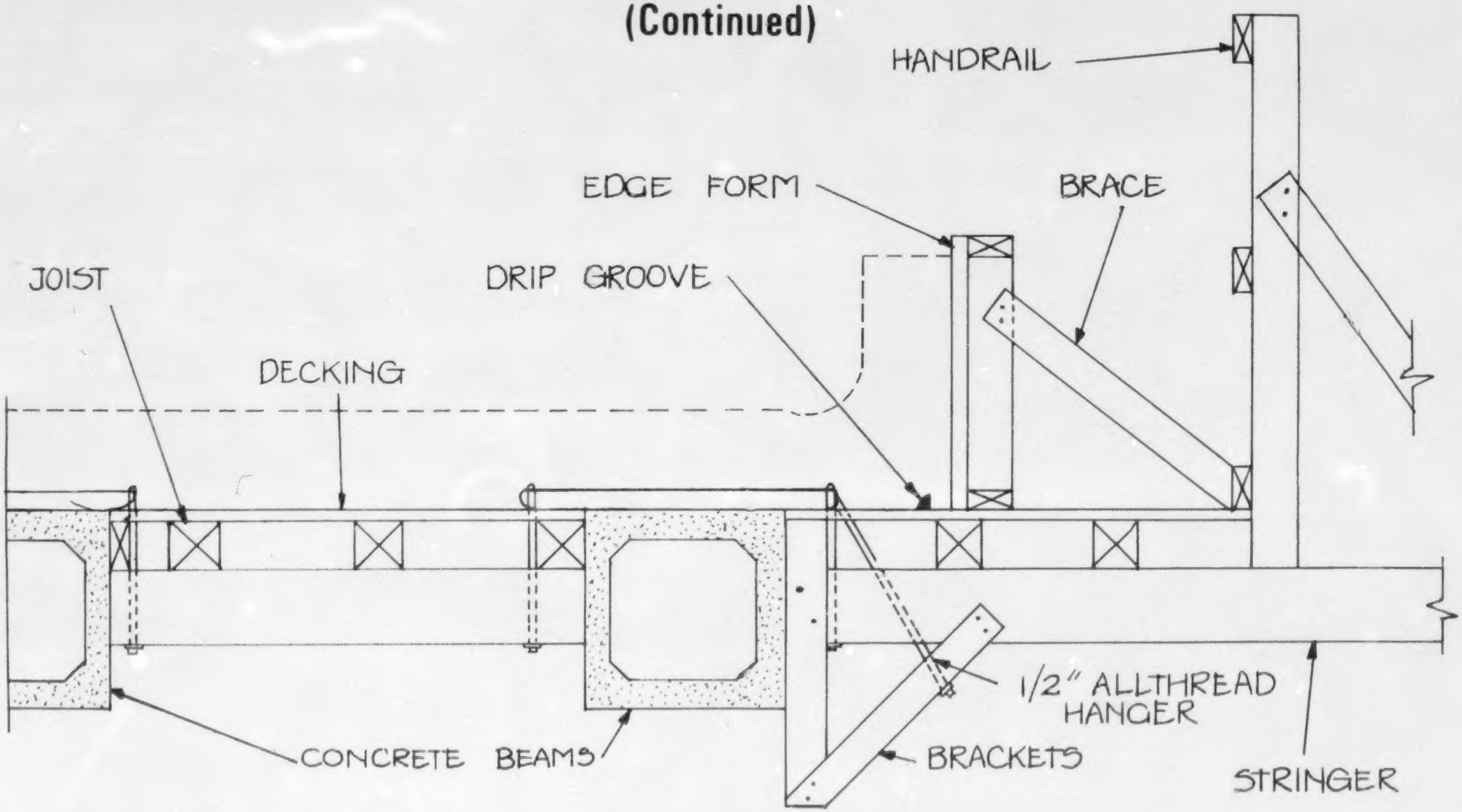
STEEL I BEAM


2'-9"
28'-0"
2'-9"
3'-3"
3'-3"

REINFORCED CONCRETE T BEAM

Types of Bridges That Use Reinforced Concrete Slabs

(Continued)


HANDRAIL
EDGE FORM
BRACE
JOIST
DRIP GROOVE
DECKING
1/2" ALLTHREAD HANGER
CONCRETE BEAMS
BRACKETS
STRINGER

PRECAST CONCRETE BEAM

SCALE: 1" = 1'

BRIDGE DECK FORMS
UNIT XI

JOB SHEET #1--CONSTRUCT FORMS FOR A BRIDGE DECK

I. Tools and materials

   A. Tools

      1. Ripping hammer, 16 oz or larger
      2. Handsaw
      3. Electric handsaw and spare blades
      4. Level, hand
      5. Wrecking bar
      6. Chalk box
      7. Wood chisel
      8. Combination square, 12"
      9. Utility knife for cutting expansion joint material

   B. Materials

      1. Brackets, job-built or manufactured
      2. Supports
      3. Decking, plywood or sheeting
      4. Joist, 2 x 6
      5. Edge form or parapet
      6. Stringer or whaler
      7. Soffit
      8. Brace
      9. Hangers to fit beam size
      10. Washers, 4" x 4" x 1/4"
      11. Form bolts, 1/2"

JOB SHEET #1

12. Allthread rod with speed thread, 1/2"
13. Nuts
14. Plastic sleeves for bolts
15. Expansion joint material
16. Water stop
17. Nails
    a. 6d
    b. 16d double head

II. Procedure

A. Size material
  1. Cut stringer material to length and nail together with 3/4" spacers
  2. Size plywood to proper width
  3. Cut joist to correct length
  4. Cut soffit to length and notch for bolts at proper spacing

B. Build brackets
  1. Build template to conform with bracket shape
  2. Cut material to correct length and size
  3. Set material in template and nail or bolt
  4. Build parapet forms
  5. Cut chamfer for exposed edges
  6. Cut drip groove

C. Erect deck supports and decking
  1. Lay out hanger position on bridge beams
  2. Assemble bolts, washers, and beam hangers with
  3. Place assembled hangers on bridge beams
  4. Hang stringers on bolts in hangers with nuts

JOB SHEET #1

5. Place joist and plywood or sheeting; if plywood, nail at edge and ends

   (NOTE: Do not overnail because it is difficult to strip. Allow space for soffit form at beam.)

6. Bring deck to grade

7. Place soffit form, wedge or block, to grade and nail

8. Hang brackets

   (NOTE: Follow steps at D.)

D. Erect brackets and decking

   1. Hang bracket
   2. Set to proper grade
   3. Lay soffit form in place
   4. Lay joist
   5. Brace joist to keep from rolling
   6. Lay plywood
   7. Lay walkway and erect railing

E. Install edge forms and/or parapet

   1. Locate and strike parapet line
   2. Nail chamfer to line
   3. Set parapet form to line, nailing with double head 16d
   4. Brace top to line
   5. Nail chamfer at top grade

F. Install bridge drain, flashing joints, and expansion dams

   (NOTE: Bridge drains are set to line and grade simultaneously with steel on a steel girder.)

   1. Cut hole in deck (drain size) at proper location

JOB SHEET #1

2. Place drain to line and 1/2" below deck grade to collect water

(NOTE: Flashing and expansion joint material usually go together. The flashing is installed about 2" below grade and there is a groove about 3/4" wide and 3/4" deep. This groove is filled with an epoxy or tar to keep the water from the joint. Expansion dams are steel. The top is set to roadway grade.)

BRIDGE DECK FORMS
UNIT XI

TEST

NAME ______________________ ______________ SCORE __________________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Braced frame used to support deck overhang

_____b. Bolt with coarse threads made to fit the helix coil of coil ties and anchors

_____c. Horizontal support member set on shores or hung

_____d. Continuous mass of concrete cast as a single unit

_____e. Piece of wood or other material that directs, resists, or supports weight or pressure

_____f. Piece of wood or metal secured across a joint to strengthen and hold the two pieces together

_____g. Board placed in a form to cut off the concrete pour

_____h. Wide boards, plywood, or metal that make up the face of the form

_____i. Paraffin oil or a manufactured product used on a form to prevent adhesion of the concrete to the form

_____j. Low form placed at the perimeter of a slab

_____k. Preformed piece of fibrous or asphaltic material used to separate units of concrete to prevent cracking due to expansion and contraction

_____l. Section of concrete larger in its horizontal dimensions than in its thickness

_____m. Horizontal sheathing that supports the wet concrete

1. Expansion joint
2. Sheathing
3. Form oil
4. Brace
5. Needle beam
6. Bulkhead
7. Monolithic pour
8. Scab
9. Coil bolt
10. Edge form
11. Bracket
12. Deck
13. Slab

______n. Part of the bridge that lets it expand and contract with temperature change

______o. Steel catch basin located on the low point of the bridge slab which is designed to drain water off the bridge slab

______p. Raised edge designed to keep cars on the roadway

______q. Wall projecting from the deck dividing opposite lanes of traffic

______r. Wall that receives the roadway and connects it to the bridge slab through the expansion joint

______s. Steel spacer beams at intervals on long girders

______t. Strip of wood or metal used as a guide for leveling or grading a concrete slab

______u. Groove in any soffit where the undersurface is exposed to weather; designed to keep water from running back on the soffit

______v. Longitudinal walk above the surface of the deck which serves as a barrier throughout the length of a bridge

14. Scuppers
15. Parapet
16. Diaphragm
17. Curb
18. Median barrier
19. Drip groove
20. Backwall
21. Screed
22. Expansion dam

2. Identify the parts of the bridge deck form on the next page by placing the correct numbers in the blanks provided.

______a. Brace

______b. Edge form (parapet)

______c. Bracket

______d. Decking

______e. Wood filler

______f. Stringer

______g. Joist

______h. Duplex nail

______i. Supports

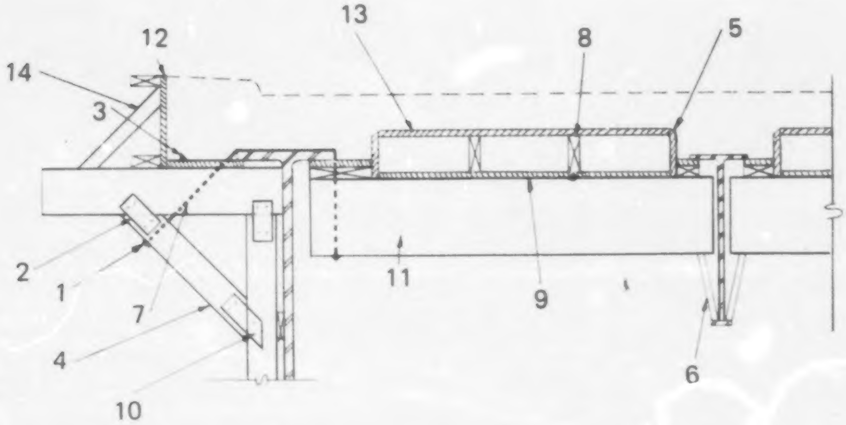
______j. Cleat

______k. Steel hangers or allthread rod (with speed thread)

______l. Washer and nut

______m. Chamfer

______n. Drip groove



3. Name the methods of supporting deck forms.

   a. ______

   b. ______

   c. ______

4. Name the types of bridges that use reinforced concrete slabs.

   a. ______

   b. ______

   c. ______

   d. ______

5. Demonstrate the ability to construct forms for a bridge deck.

   (NOTE: If this has not been accomplished prior to the test, ask the instructor when the above activity should be completed.)

BRIDGE DECK FORMS
UNIT XI

ANSWERS TO TEST

1. a. 11
   b. 9
   c. 5
   d. 7
   e. 4
   f. 8
   g. 6
   h. 2
   i. 3
   j. 10
   k. 1
   l. 13
   m. 12
   n. 22
   o. 14
   p. 17
   q. 18
   r. 20
   s. 16
   t. 21
   u. 19
   v. 15

2. a. 14
   b. 12
   c. 4
   d. 13
   e. 9
   f. 11
   g. 8
   h. 10
   i. 6
   j. 2
   k. 7
   l. 1
   m. 5
   n. 3

3. a. Bracket and hanger
   b. Needle beam
   c. Leg supports
4. a. Reinforced concrete slab
   b. Steel I beam
   c. Reinforced concrete T beam
   d. Precast concrete beam
5. Performance skills evaluated to satisfaction of the instructor

COMMERCIAL CARPENTRY
PROGRESS CHART

Section G-1
Forming

Job	UNIT I INTRODUCTION TO FORMING		UNIT II FOOTING FORMS					UNIT III EDGE FORMS ON GRADE				UNIT IV WALL FORMS								
	1	2	1	2	3	4	5	1	2	3	4	1	2	3	4	5	6	7	8	9
Student's Name	UNIT TEST		UNIT TEST	Construct & Set Forms for Continuous Footing	Construct & Set Forms for Pile Cap	Construct & Set Forms for Pier Footing	Strip Pier Footing Forms & Prepare for Erection at Another Location	UNIT TEST	Construct Edge Forms for Slab on Grade Without Foundation	Construct Edge Forms for Slab on Grade with Foundation	Construct Edge Forms for Patio	UNIT TEST	Material Estimating	Estimate Width and Number of Panels	Construct Straight Wall with Patented Forms	Construct Gang Forms for Battered Wall	Construct Circular Wall Forms Built in Place	Construct Panel Forms	Construct Slip Forms	Remove Forms & Prepare for Storage
1																				
2																				
3																				
4																				
5																				
6																				
7																				

	Accuracy	85% Correct	85% Correct	Within 1/2" of Line and Grade	Within 1/2" of Line and Grade	Within 1/2" of Line and Grade	To Satisfaction of Instructor	85% Correct	Within 1/4" of Line & Grade @ 50'	Within 1/4" of Line & Grade @ 50'	Within 1/4" of Line & Grade @ 50'	85% Correct	To Satisfaction of Instructor	To Satisfaction of Instructor	Within 1/4" of Line & Grade @ 50'	Within 1/4" of Line & Grade @ 50'	Within 1/4" of Line & Grade @ 50'	Within 1/4" of Line @ Grade at 50'	To Satisfaction of Instructor	To Satisfaction of Instructor
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

COMMERCIAL CARPENTRY
PROGRESS CHART

Section G-2
Forming

Job

Student's Name	UNIT V ON GRADE CURB FORMS			UNIT VI VERTICAL PIERS AND COLUMNS					UNIT VII HORIZONTAL BEAM FORMS					UNIT VIII ABOVE GRADE SLAB SYSTEMS						
	1	2	3	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6	7
	UNIT TEST	Construct Curb & Gutter Form		UNIT TEST	Construct Forms for Round Fluted Column	Construct Forms for Square Column	Set Round Column (Fiberboard Tube)		UNIT TEST	Construct Spandrel Beam Form	Construct Interior Beam Form	Construct Inverted Beam Form Post-Tensioned		UNIT TEST	Construct Forms for Two-Way Joist System	Construct Forms for One-Way Joist System	Construct & Erect Forms for Flying Flat Slab	Strip Two-Way Joist Form System (Waffle)	Set Concealed Void Tubes	
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

		85% Correct	Within 1/4" of Line & Grade @ 50'		85% Correct	Within 1/4" Plumb in 10'	Within 1/8" of Square	Within 1/4" Plumb in 10'		85% Correct	Within 1/4" of Level in 10'	Within 1/4" of Level in 10'	Within 1/4" of Level in 10'		85% Correct	Within 1/4" of Line & Grade; Within 1/8" of Level in 10'	Within 1/4" of Line & Grade; Within 1/8" of Level in 10'	Within 1/4" of Line & Grade; Within 1/8" of Level in 10'	Within 1/4" of Line & Grade; Within 1/8" of Level in 10'	Within 1/4" of Line & Grade; Within 1/8" of Level in 10'
8																				
9																				
10																				
11																				
12																				
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14																				
15																				
16																				
17																				
18																				
19																				
20																				

COMMERCIAL CARPENTRY
PROGRESS CHART

Section G-3
Forming

	UNIT IX FIREPROOF ENCASEMENT FORMS			UNIT X STAIR FORMS				UNIT XI BRIDGE DECK FORMS												
	1	2	3	1	2	3	4	1	2	3	4									
Job Student's Name	UNIT TEST	Construct Fireproof Encasement Forms for Columns & Beams		UNIT TEST	Construct Forms for Suspended Stairs	Construct Forms for Stairs on Earth	Construct Forms for Short Flights of Stairs	UNIT TEST	Construct Forms for Bridge Deck											
1																				
2																				
3																				
4																				
5																				
6																				
7																				

	Accuracy	85% Correct	Within 1/4" of Plumb & Level; Within 1/8" of Square		85% Correct	Within 1/8" of Level Across Nose of Tread & Within 1/4" of Specified Dimensions			85% Correct	Within 1/4" of Level & Elevation in 10'												
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					
18																					
19																					
20																					

section H
Framing

FLOOR AND SILL FRAMING
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify floor and sill framing members, identify the styles of framing, and state the purposes of a sill sealer and termite shield. The student should also be able to name the methods of fastening the sill to the foundation, build a box sill and install the floor joist, list and lay the various types of subflooring, and estimate materials needed to frame a floor and sill and to lay a subfloor. This knowledge will be evidenced by completion of the assignment sheet, job sheets, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with floor and sill framing to the correct definitions.
2. Identify styles of framing.
3. Identify framing members that make up the floor and sill.
4. State the purpose of a sill sealer.
5. State the purpose of a termite shield.
6. Name methods of fastening sills to foundation walls.
7. State the purpose of bridging.
8. Name types of bridging.
9. State the purpose of beams or girders.
10. State the purpose of joist hangers.
11. List types of subflooring.
12. Match fasteners to their uses.
13. Estimate the amount of material needed to frame a floor and sill and to lay a subfloor.
14. Demonstrate the ability to:
    a. Build a box sill and install a floor joist.
    b. Install bridging.

c. Lay a subfloor.

d. Install floor joists for cantilever floor.

FLOOR AND SILL FRAMING
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Western or Platform Framing

      2. TM 2--Balloon Framing

      3. TM 3--Modern Braced Framing

      4. TM 4--Framing Adaptions for Saving Energy

      5. TM 5--Floor and Sill Members

      6. TM 6--Fastening Sills to Foundation

      7. TM 7--Some Types of Joist Hangers

      8. TM 8--Subflooring: Lumber Laid Diagonally to Joist

      9. TM 9--Subflooring: Lumber Laid at Right Angles to Joist

      10. TM 10--Subflooring: 4' x 8' Plywood

      11. TM 11--Fasteners

      12. TM 12--Framing Procedure for Parallel Floor Joists

D. Assignment Sheet #1--Material Estimating (Floor and Sill)

E. Answers to assignment sheet

F. Job sheets

   1. Job Sheet #1--Build a Box Sill and Install a Floor Joist
   2. Job Sheet #2--Install Bridging
   3. Job Sheet #3--Lay a Subfloor
   4. Job Sheet #4--Install Floor Joists for Cantilever Floor

G. Test

H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago, Illinois: American Technical Society, 1955.

B. Cooper, George H., and Badzinski, Stanley Jr. *Building and Construction Estimating*. New York: McGraw-Hill, 1971.

C. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry*. 3rd ed. Chicago, Illinois: American Technical Society, 1963.

D. Feirer, John L. *Woodworking for Industry*. Peoria, Illinois: Charles A. Bennett Company, Inc., 1971.

E. Groneman, Chris H., and Galzener, Everett R. *Technical Woodworking*. St. Louis, Missouri: McGraw-Hill Book Company, 1966.

F. Wagner, Willis H. *Modern Carpentry*. Homewood, Illinois: Goodheart-Willcox, 1969.

G. Ramsey, Charles G., and Sleeper, Harold R. *Architectural Graphic Standards*. 4th ed. New York: John Wiley and Sons, Inc., 1951.

FLOOR AND SILL FRAMING
UNIT I

INFORMATION SHEET

I. Terms and definitions

   A. Balloon framing--Type of building construction in which the studs extend in one piece from the foundation to the roof

   B. Beam or girder--Any large piece of timber, stone, iron, or other material used to support concentrated loads at particular points along its length

   C. Bridging--Solid lumber or small wooden or steel pieces fitted in pairs from the bottom of one joist to the top of the adjacent joist and crossed to stiffen and help distribute the load

   D. Crown--Relating to the high side of the crook in framing lumber

   E. Foundation--Supporting portion of a structure below the first floor construction including the footings

   F. Joist header--Framing member into which the common joists are fitted forming the box sill; member used to support the free end of joists over openings, such as stairs and chimneys

   G. Joist--One of a series of parallel framing members used to support floor and ceiling loads and supported, in turn, by beams or girders

   H. Sill--Lowest member of the frame of a structure resting horizontally on the foundation and supporting the uprights of the frame

   I. Sill sealer--Resilient waterproof material used under the sills as a seal against air, dirt, and insects

   J. Subfloor--Boards or panels laid directly on the floor joists over which a finished floor will be laid

   K. Termite shield--Shield, usually made of sheet metal, placed on a foundation wall or around pipes to prevent the passage of termites into the structure

   L. Western framing--System of framing a buiding where the floor joists of each story rest on the top plates of the story below, and the bearing walls and partitions rest on the subfloor of each story

   M. Joist hangers--Metal saddles secured to face of girder in which joist ends rest

INFORMATION SHEET

II. Framing styles (Transparencies 1, 2, 3, and 4)

   A. Western or platform framing

      (NOTE: Western framing is sometimes called *platform framing.*)

   B. Balloon framing

   C. Modern braced framing

   D. Framing adaptions for saving energy

III. Floor and sill framing members (Transparency 5)

   (NOTE: Western and balloon framing styles use basically the same members.)

   A. Sill sealer

   B. Termite shield

   C. Sill

   D. Joist

   E. Joist header

   F. Beam or girder

   G. Bridging

   H. Subfloor

IV. Purpose of sill sealer--Provides a seal against air, dirt, and insects (Transparency 5)

   (NOTE: This is applied between the sill and the foundation wall.)

V. Purpose of termite shield--Prevents the passage of termites to the structure (Transparency 5)

   (NOTE: This is applied between the sill sealer and the sill and around pipes.)

VI. Methods of fastening sills to foundation walls (Transparency 6)

   A. Sill anchor

      (NOTE: This consists of a bolt embedded in the foundation wall that projects through the sill and provides an anchor for the sill.)

INFORMATION SHEET

B. Concrete nail

(NOTE: This consists of a hardened steel nail which is driven or shot through the sill into the foundation wall.)

VII. Purpose of bridging--Stiffens and helps distribute the load (Transparency 5)

VIII. Types of bridging (Transparency 5)

A. Solid lumber bridging

(NOTE: The same size material is used as for the joist and is staggered during installation to facilitate nailing.)

B. Lumber X bridging

(NOTE: This is usually made from 1 x 4 lumber and fitted in pairs from the bottom of one joist to the top of the adjacent joist and crossed.)

C. Adjustable steel X bridging

(NOTE: Steel bridging is adjustable to fit on 16" or 24" centers and should be installed according to the manufacturer's recommendations.)

IX. Purpose of beams or girders--Support concentrated loads at particular points along their lengths (Transparency 5)

(NOTE: These may be any large piece of timber, stone, iron, or other material used to span an open area upon which the floor joists rest.)

X. Purpose of joist hangers--Support the ends of the joist (Transparency 7)

XI. Types of subflooring (Transparencies 8, 9, and 10)

(NOTE: Before subflooring is installed all plumbing, heating, and air conditioning rough-in work should be done.)

A. Lumber

(NOTE: One-inch lumber is usually placed at a diagonal across the joist.)

B. Plywood

(NOTE: Usually 5/8" x 4' x 8' CD, exterior grade, fir plywood is recommended.)

XII. Fasteners (Transparency 11)

A. Sill anchors--Used to anchor the sill to the foundation

B. Masonry nails--Used to anchor the sill to the foundation

INFORMATION SHEET

C. Box nails

1. 16d box nails--Used to fasten joist to sill and headers to joist

2. 8d box nails--Used to fasten subfloor to joist

XIII. Material estimating

(NOTE: See building specifications for kinds and dimensions of material.)

A. Sill sealer--Linear feet

(NOTE: Obtain enough to cover all foundation surfaces.)

B. Termite shield--Linear feet

(NOTE: This shield usually consists of twenty-six gauge galvanized material approximately 12" wide covering all foundation surfaces.)

C. Sill--Board feet

(NOTE: The sill may be 2 x 4 or 2 x 6. Obtain enough to cover all foundation surfaces.)

D. Beams or girders--Board feet

(NOTE: Material must be of sufficient strength to carry the expected load, including enough to span all areas where required. See specifications.)

E. Joists--Board feet

1. Determine length needed from foundation plan and round up to the nearest even foot

2. Determine the number of joists needed

a. For 16" on center

1) Multiply length of building by 3/4

2) Add one joist for the end

(NOTE: Add one joist for each partition that runs parallel to the joists.)

INFORMATION SHEET

b. For 24" on center

1) Multiply length of building by 1/2

2) Add one joist for the end

(NOTE: Add one joist for each partition that runs parallel to the joists.)

F. Joist headers--Board feet

(NOTE: Allow enough for twice the length of the building and all openings.)

G. Bridging

(NOTE: One row of bridging is required in spans over 8' in length and less than 16'. Two rows of bridging are required in spans over 16'.)

1. Wood **X** bridging--Board feet

(NOTE: Bridging usually consists of 1 x 4 rough lumber.)

a. Determine the number of rows of bridging needed

b. Determine the length of each row of bridging

c. Multiply the sum of all the row lengths in lineal feet by the appropriate factor from the following table to get the total lineal feet of bridging needed for the job

Joist Size	Spacing, In. O.C.	Lineal Feet of Material Per Foot of Bridging Row
2 x 6 to 2 x 10	16	2
2 x 12	16	2 1/4
2 x 14	16	2 1/2

(NOTE: If the joists are 24" on center, the total lineal footage of bridging rows is equal to the number of pieces of bridging material needed.)

2. Steel bridging--Number of each for joists 16" on center

a. Determine the number of rows of bridging needed

b. Determine the length of each row of bridging

INFORMATION SHEET

c. Multiply the total lineal footage of bridging rows by 3/4 to find the number of spaces between joists 16" on center

d. Multiply the above total by two to determine the number of pieces of bridging required

(NOTE: If the joists are 24" on center, the total lineal footage of rows is equal to the number of pieces of metal bridging needed.)

3. Solid lumber bridging

   a. Determine the number of rows of bridging needed

   b. Determine the length of each row of bridging

   c. Multiply the number of rows by the length of each row to determine the total lineal feet of bridging needed

H. Subflooring

1. Lumber--Board feet

   (NOTE: Lumber recommended is usually 1 x 6 or 1 x 8 and may be laid diagonally or at right angles to the joist.)

   a. Calculate the area of the entire floor to be covered ignoring small openings in the floor

      (NOTE: Length times width equals area.)

   b. Calculate the amount of material that must be allowed for waste by using the following table and add to the total area

Material	Allowance When Laid at Right Angles to Joists, %	Allowance When Laid Diagonally, %
1 x 6 tongued and grooved	20	25
1 x 8 tongued and grooved	15	20
1 x 6 shiplap	20	25
1 x 8 shiplap	15	20
1 x 6 square edge	12	17
1 x 8 square edge	10	15

(NOTE: A rule of thumb is that for 1 x 6 lumber add to the total area 1/6 for waste and for 1 x 8 lumber add 1/8.)

INFORMATION SHEET

2. Plywood--Square feet or number of pieces

   (NOTE: Usually 5/8" x 4' x 8' plywood is recommended.)

   a. Calculate the entire floor area

      (NOTE: When laid at right angles to the joist, the waste is negligible.)

   b. Divide the square feet of area by 32 and round up to the next whole number to determine the number of pieces needed

I. Nails--Pounds

1. 16d box for joists--10 pounds per 1,000 board feet

2. 8d box

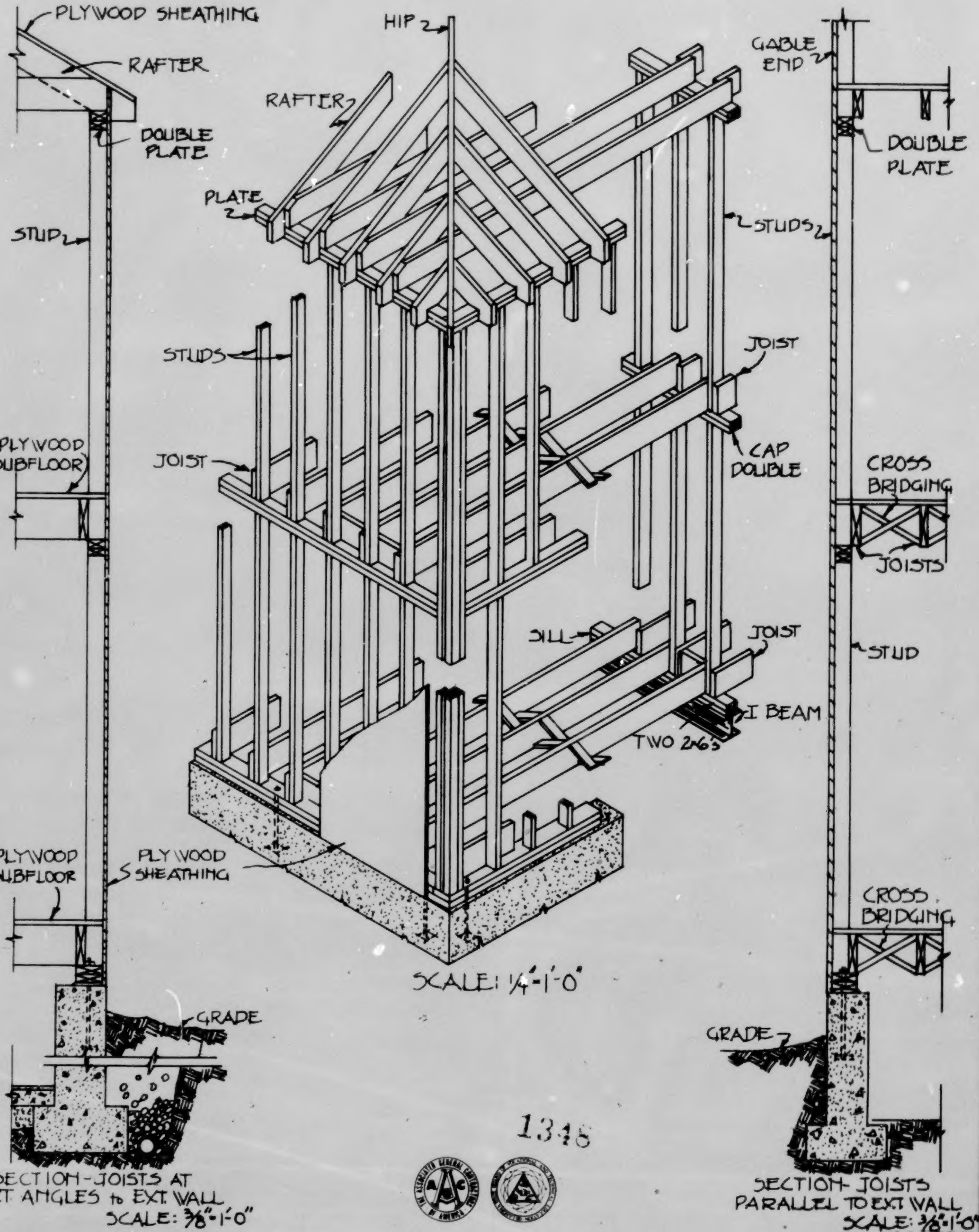
   a. For bridging--2 pounds per 100 lineal feet

   b. For lumber subfloor--32 pounds per 1,000 board feet

   c. For plywood subfloor--10 pounds per 1,000 square feet

Western or Platform Framing

CC - 13-H


PLYWOOD SHEATHING
RAFTER
DOUBLE PLATE
STUD
PLYWOOD SUBFLOOR
PLYWOOD SUBFLOOR
PLYWOOD SHEATHING
GRADE
HIP
RAFTER
PLATE
STUDS
JOIST
STUDS
JOIST
CAP DOUBLE
SILL
JOIST
I BEAM
TWO 2x6's
GABLE END
DOUBLE PLATE
STUDS
CROSS BRIDGING
JOISTS
STUD
CROSS BRIDGING
GRADE

SCALE: 1/4"-1'-0"

1348

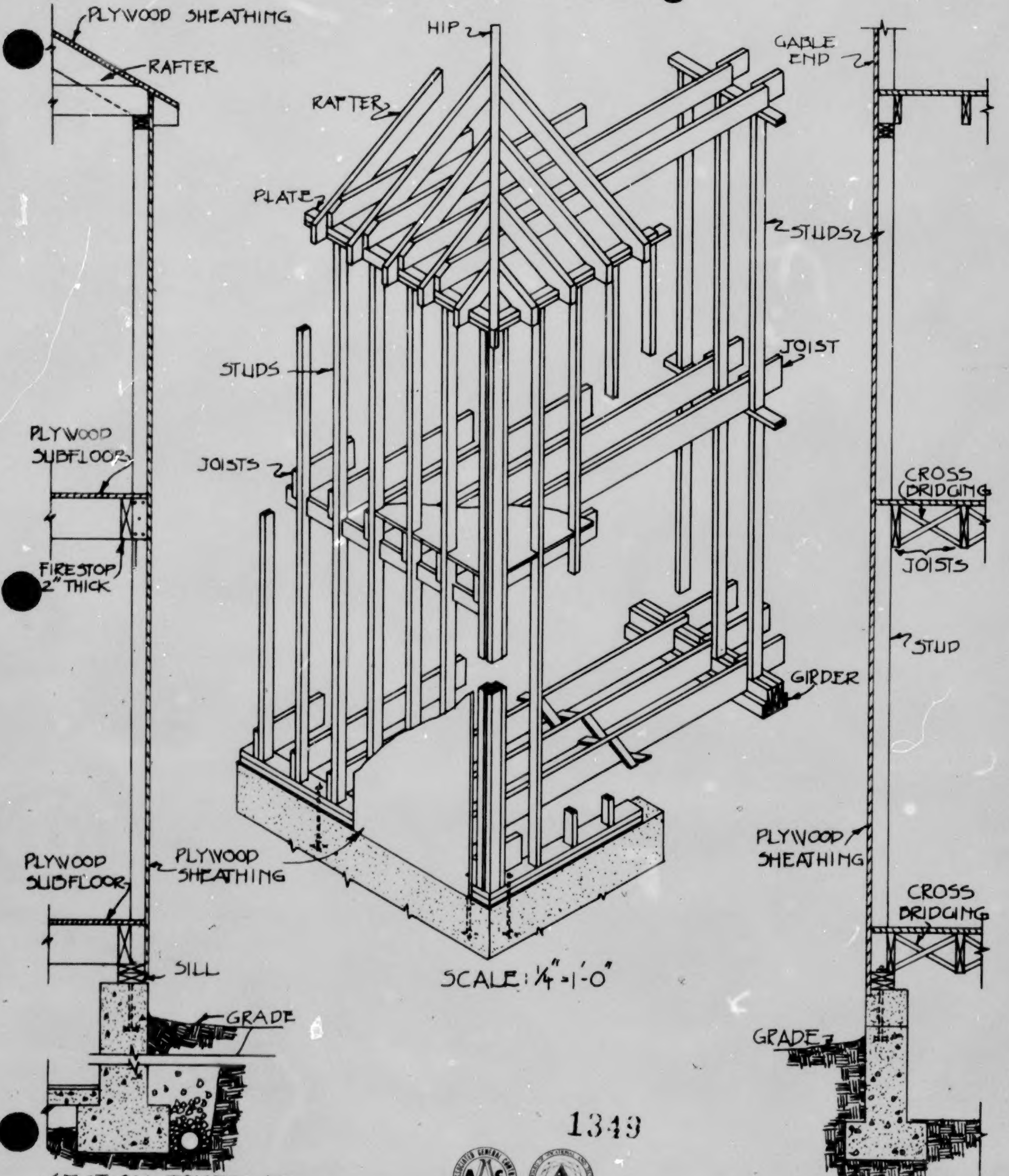
SECTION-JOISTS AT
RT. ANGLES to EXT. WALL
SCALE: 3/8"-1'-0"

SECTION-JOISTS
PARALLEL TO EXT. WALL
SCALE: 3/8"-1'-0"

TM 1

Balloon Framing

CC - 15-H


PLYWOOD SHEATHING
RAFTER
PLYWOOD SUBFLOOR
FIRESTOP 2" THICK
PLYWOOD SUBFLOOR
PLYWOOD SHEATHING
SILL
GRADE
HIP
RAFTER
PLATE
STUDS
JOISTS
STUDS
JOIST
GIRDER
GABLE END
CROSS BRIDGING
JOISTS
STUD
PLYWOOD SHEATHING
CROSS BRIDGING
GRADE

SCALE: 1/4"=1'-0"

SECTION JOISTS AT RT. ANGLES TO EXT. WALL
SCALE: 3/8"=1'-0"

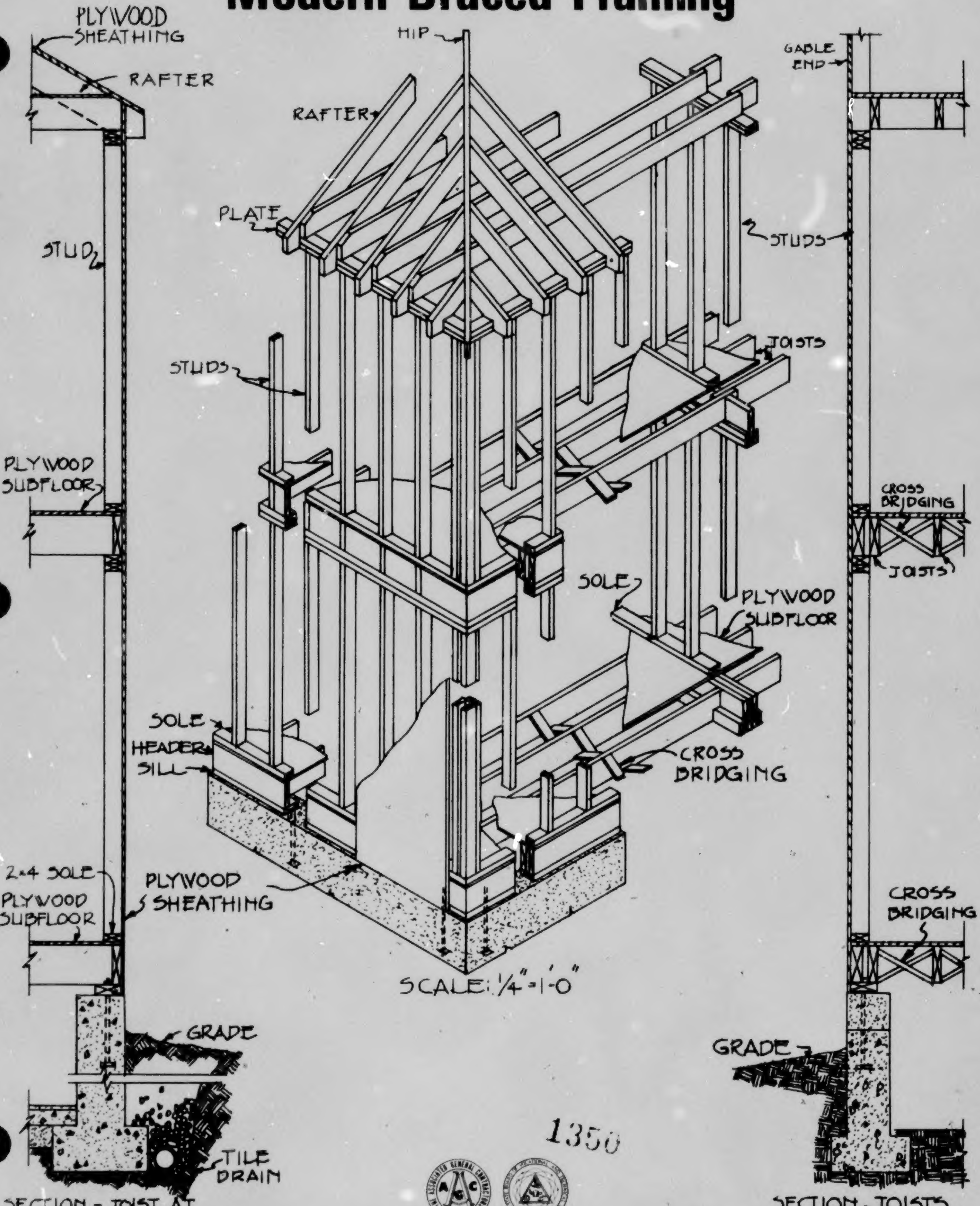
SECTION-JOISTS PARALLEL TO EXT. WALL
SCALE 3/8"=1'-0"

1349

TM 2

CC - 17-H

Modern Braced Framing


PLYWOOD SHEATHING
RAFTER
STUD
PLYWOOD SUBFLOOR
2×4 SOLE
PLYWOOD SUBFLOOR
PLYWOOD SHEATHING
GRADE
TILE DRAIN
HIP
RAFTER
PLATE
STUDS
SOLE
HEADER
SILL
STUDS
JOISTS
SOLE
PLYWOOD SUBFLOOR
CROSS BRIDGING
GABLE END
CROSS BRIDGING
JOISTS
CROSS BRIDGING
GRADE

SCALE: 1/4"=1'-0"

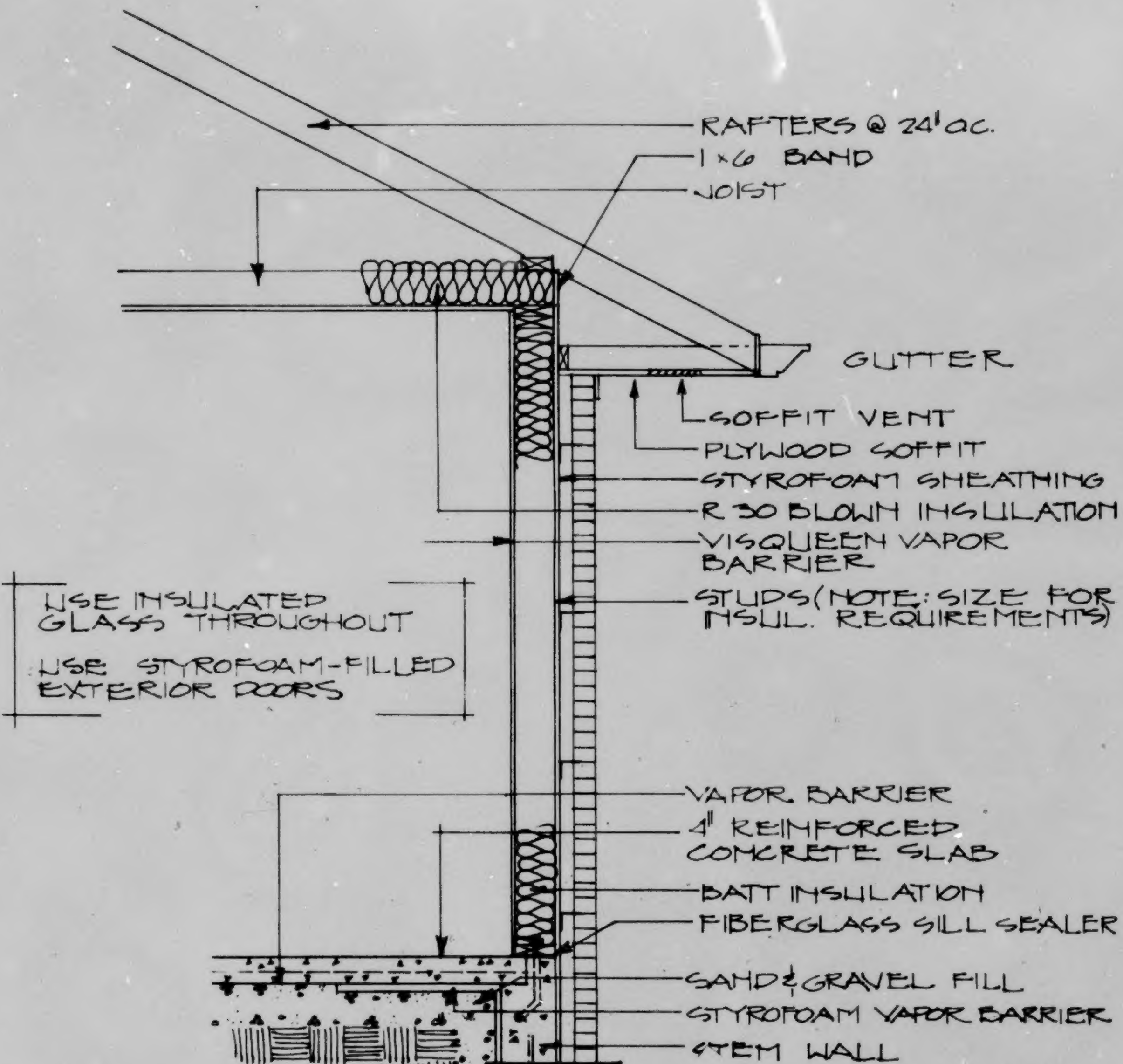
1350

SECTION - JOIST AT RT. ANGLES TO EXT. WALL, SCALE: 3/8"=1'-0"

SECTION - JOISTS PARALLEL TO EXT. WALL SCALE: 3/8"=1'-0"

TM 3

Framing Adaptions for Saving Energy


RAFTERS @ 24' O.C.
1 × 6 BAND
JOIST
GUTTER
SOFFIT VENT
PLYWOOD SOFFIT
STYROFOAM SHEATHING
R 30 BLOWN INSULATION
VISQUEEN VAPOR BARRIER
STUDS (NOTE: SIZE FOR INSUL. REQUIREMENTS)
VAPOR BARRIER
4" REINFORCED CONCRETE SLAB
BATT INSULATION
FIBERGLASS SILL SEALER
SAND & GRAVEL FILL
STYROFOAM VAPOR BARRIER
STEM WALL
REINFORCING BARS
FOOTING

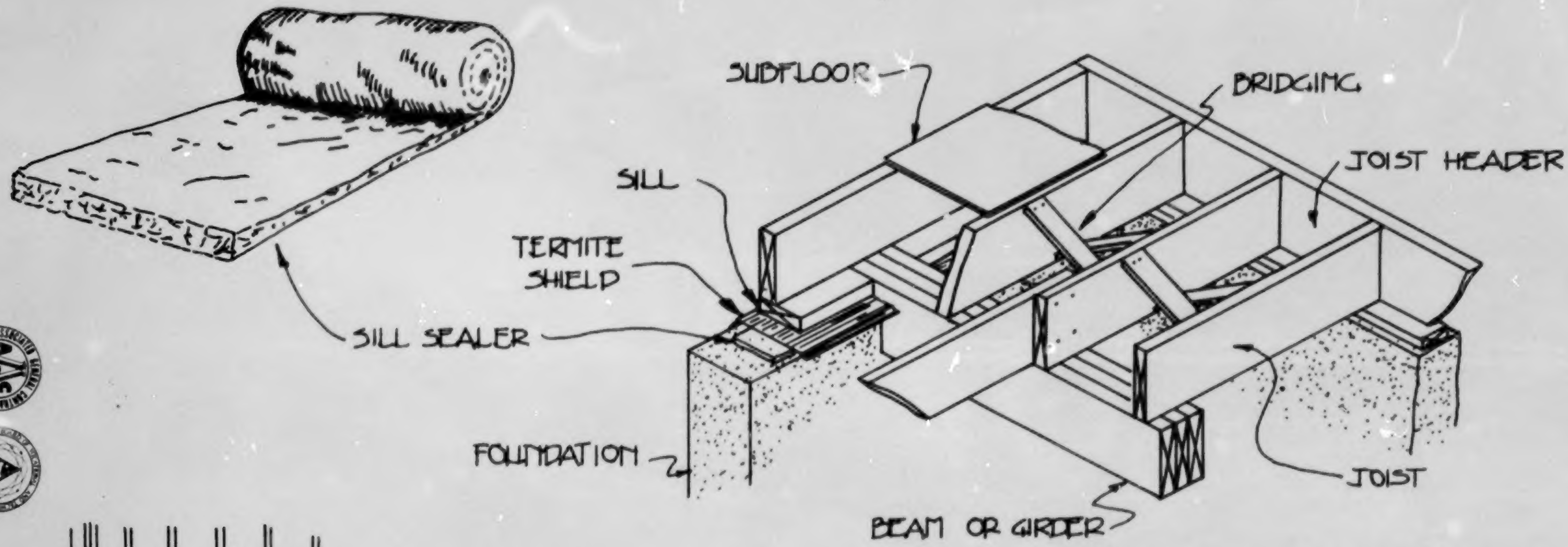
USE INSULATED GLASS THROUGHOUT

USE STYROFOAM-FILLED EXTERIOR DOORS

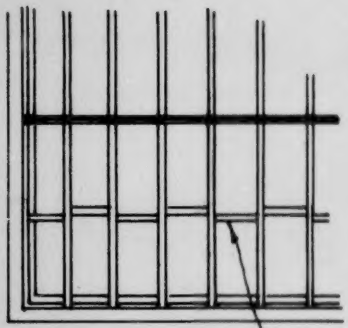
NOTE: FRAMING DIMENSIONS WILL VARY IN DIFFERENT LOCALITIES AS WILL THE INSULATION

SCALE 1/2" = 1'-0"

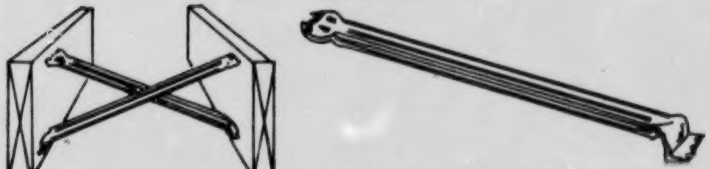
Floor and Sill Members


SUBFLOOR
BRIDGING
JOIST HEADER
SILL
TERMITE SHIELD
SILL SEALER
FOUNDATION
JOIST
BEAM OR GIRDER

SCALE: 1/2"=1'-0"



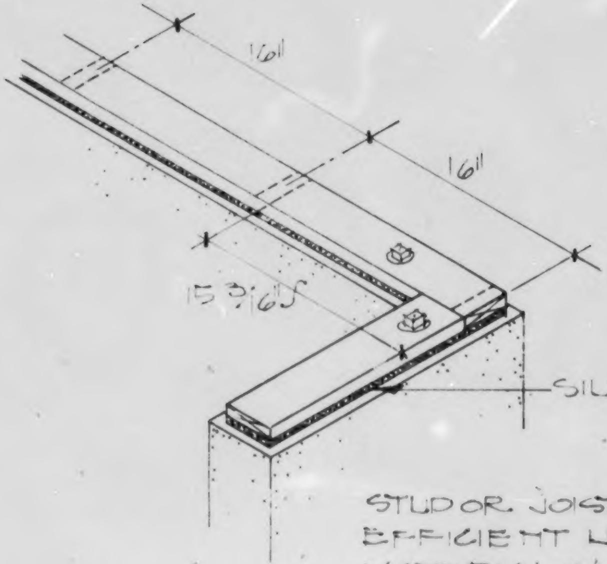
SOLID BRIDGING



STEEL BRIDGING

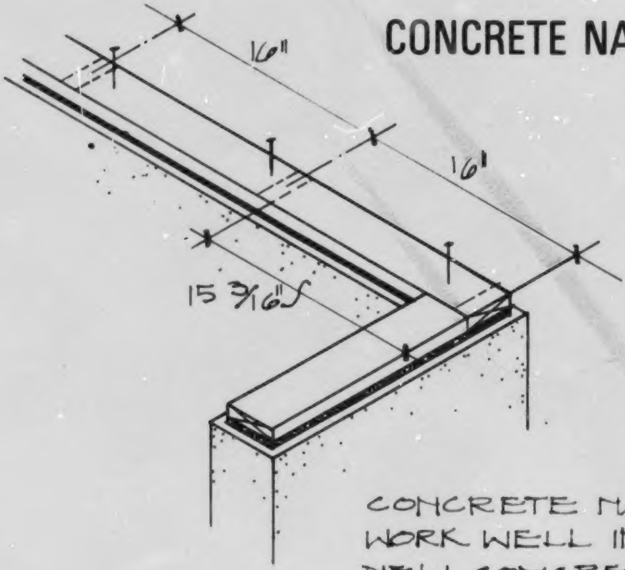
Fastening Sills to Foundation

SILL ANCHORS


16"
16"
15 3/16"
SILL SEALER

STUD OR JOIST SPACING PERMITS EFFICIENT USE OF MODULAR MATERIALS

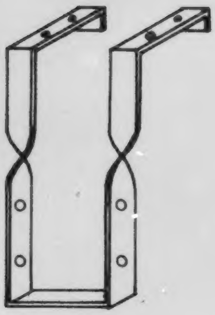
CONCRETE NAILS

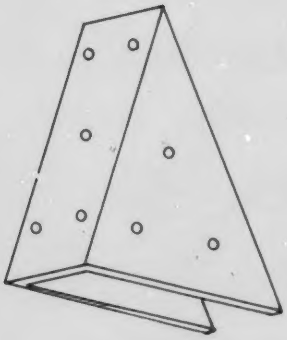


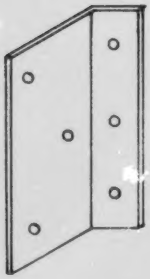
CONCRETE NAILS WORK WELL IN NEW CONCRETE

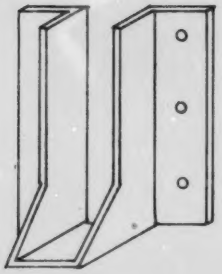
SCALE 1"=1'-0"

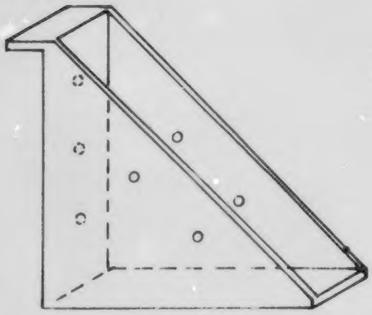
Some Types of Joist Hangers

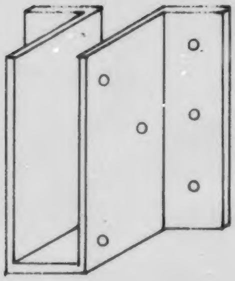










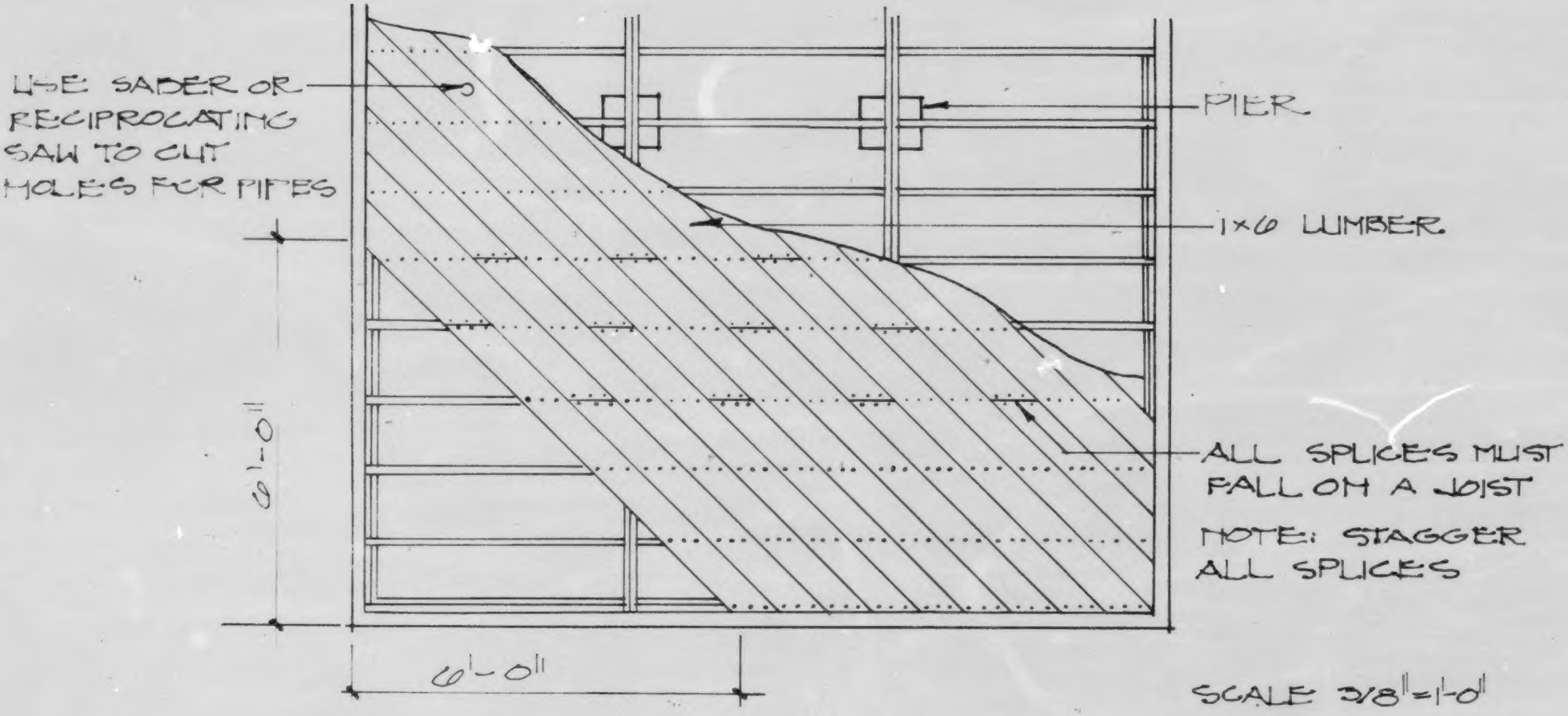


SCALE: 3"=1'-0"

NOTE: OTHER TYPES OF JOIST HANGERS ARE AVAILABLE
FROM THE VARIOUS MANUFACTURERS

Subflooring

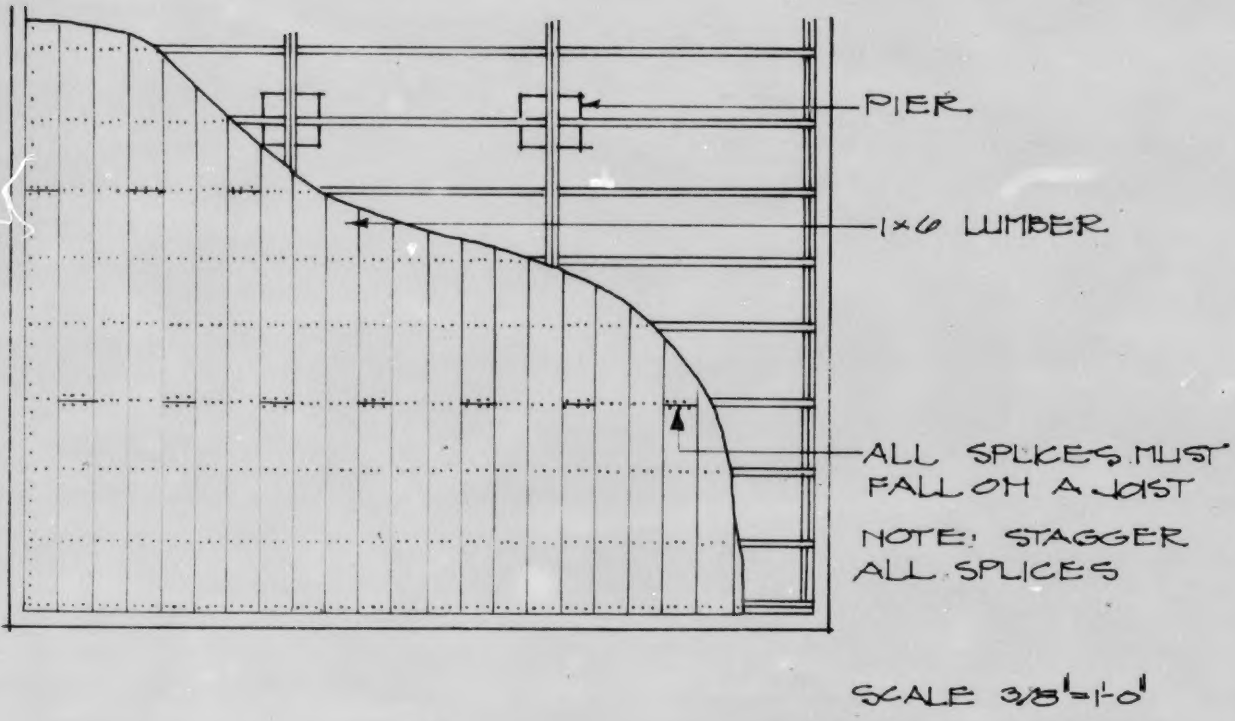
Lumber Laid Diagonally to Joist


USE SABER OR RECIPROCATING SAW TO CUT HOLES FOR PIPES
PIER
1×6 LUMBER
ALL SPLICES MUST FALL ON A JOIST
NOTE: STAGGER ALL SPLICES
6'-0"
6'-0"
SCALE 3/8"=1'-0"

Subflooring

(Continued)

Lumber Laid at Right Angles to Joist


PIER
1×6 LUMBER
ALL SPLICES MUST FALL ON A JOIST
NOTE: STAGGER ALL SPLICES
SCALE 3/8"=1'-0"

BRIDGE DECK FORMS
UNIT XI

JOB SHEET #1--CONSTRUCT FORMS FOR A BRIDGE DECK

I. Tools and materials

- A. Tools
    1. Ripping hammer, 16 oz or larger
    2. Handsaw
    3. Electric handsaw and spare blades
    4. Level, hand
    5. Wrecking bar
    6. Chalk box
    7. Wood chisel
    8. Combination square, 12"
    9. Utility knife for cutting expansion joint material
- B. Materials
    1. Brackets, job-built or manufactured
    2. Supports
    3. Decking, plywood or sheeting
    4. Joist, 2 x 6
    5. Edge form or parapet
    6. Stringer or whaler
    7. Soffit
    8. Brace
    9. Hangers to fit beam size
    10. Washers, 4" x 4" x 1/4"
    11. Form bolts, 1/2"

JOB SHEET #1

12. Allthread rod with speed thread, 1/2"
13. Nuts
14. Plastic sleeves for bolts
15. Expansion joint material
16. Water stop
17. Nails
    a. 6d
    b. 16d double head

II. Procedure

A. Size material

1. Cut stringer material to length and nail together with 3/4" spacers
2. Size plywood to proper width
3. Cut joist to correct length
4. Cut soffit to length and notch for bolts at proper spacing

B. Build brackets

1. Build template to conform with bracket shape
2. Cut material to correct length and size
3. Set material in template and nail or bolt
4. Build parapet forms
5. Cut chamfer for exposed edges
6. Cut drip groove

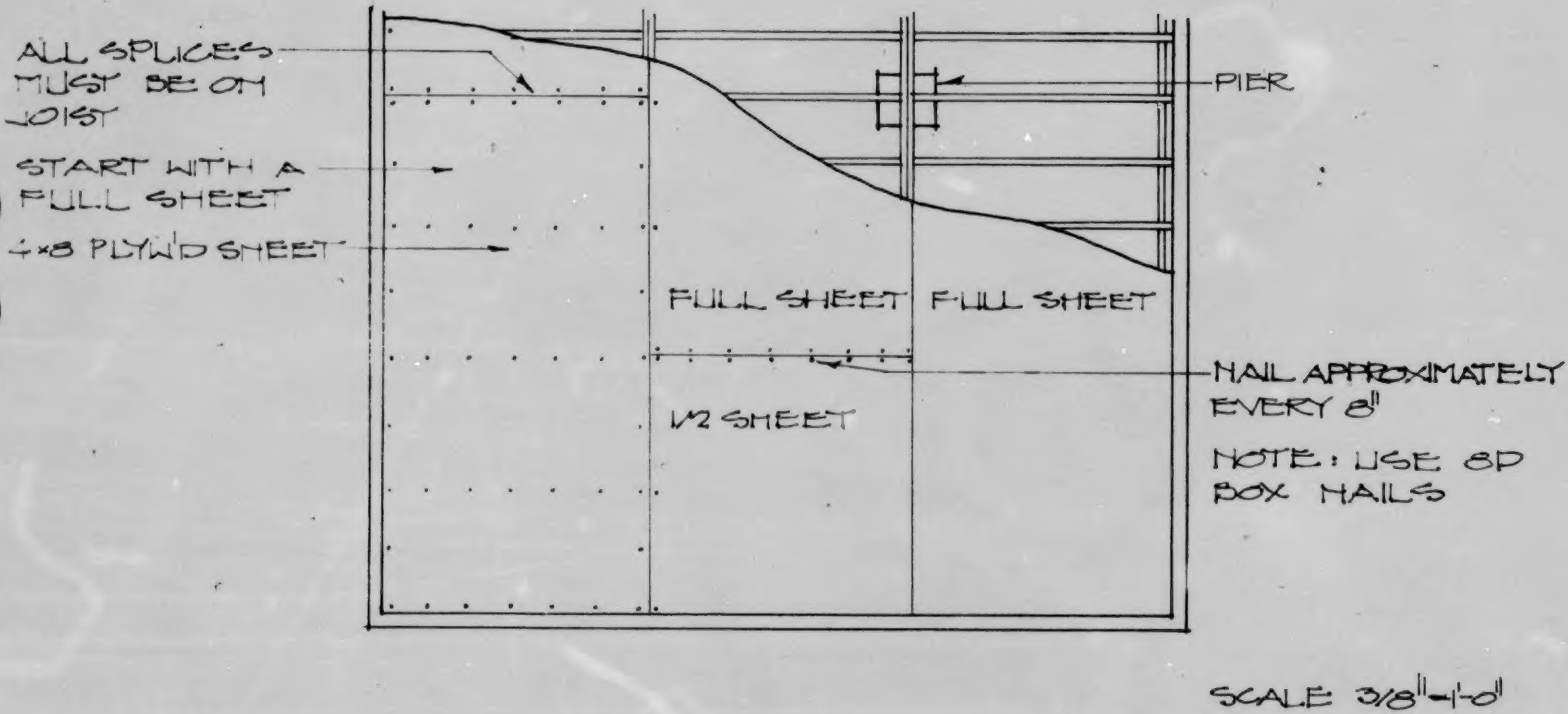
C. Erect deck supports and decking

1. Lay out hanger position on bridge beams
2. Assemble bolts, washers, and beam hangers with [illegible]
3. Place assembled hangers on bridge beams
4. Hang stringers on bolts in hangers with nuts

Subflooring

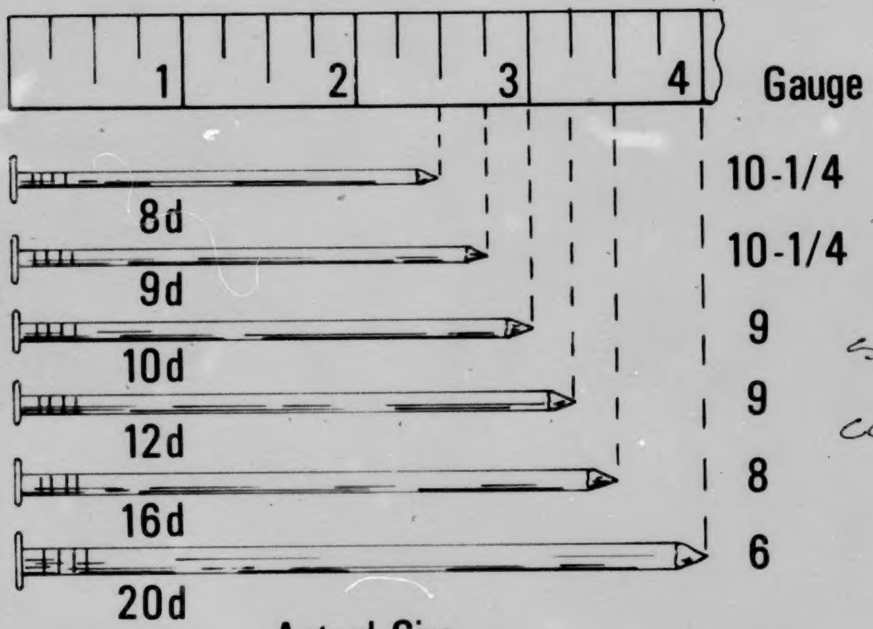
(Continued)

4'x 8' Plywood


ALL SPLICES MUST BE ON JOIST
START WITH A FULL SHEET
4×8 PLYW'D SHEET
PIER
FULL SHEET
FULL SHEET
1/2 SHEET
NAIL APPROXIMATELY EVERY 8"
NOTE: USE 8D BOX NAILS
SCALE 3/8"-1'-0"

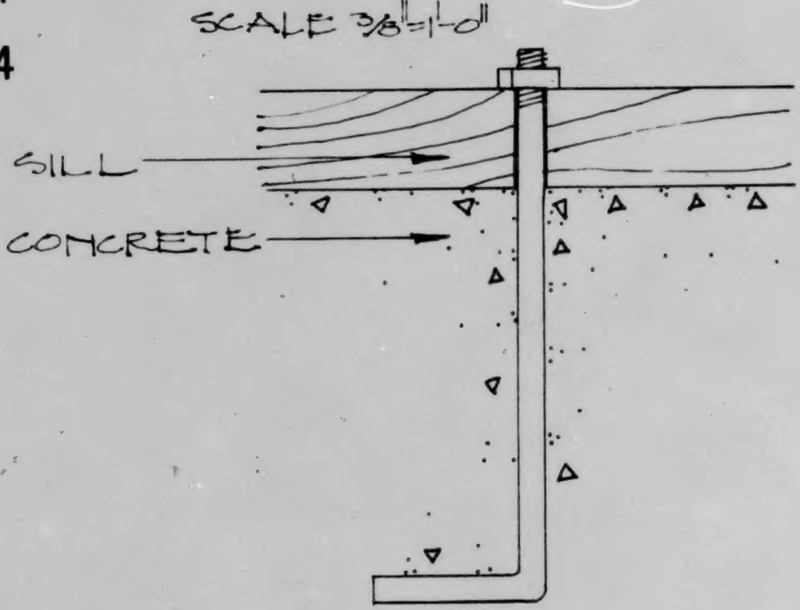
Fasteners

Box Nails


1
2
3
4
Gauge
10-1/4
8d
10-1/4
9d
9
10d
9
12d
8
16d
6
20d

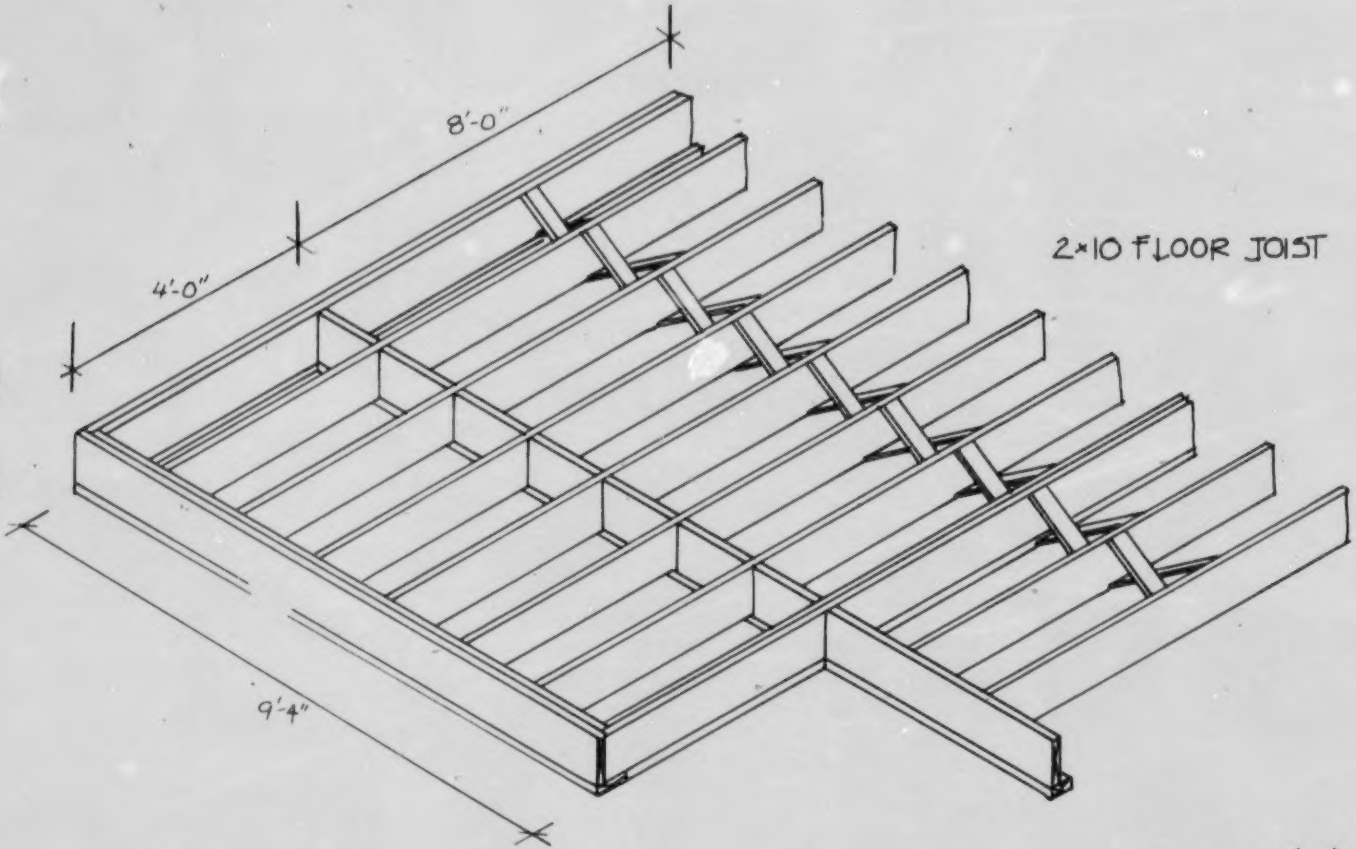
Actual Size

Sill Anchor


SCALE 3/8"=1'-0"
SILL
CONCRETE

Masonry Nail

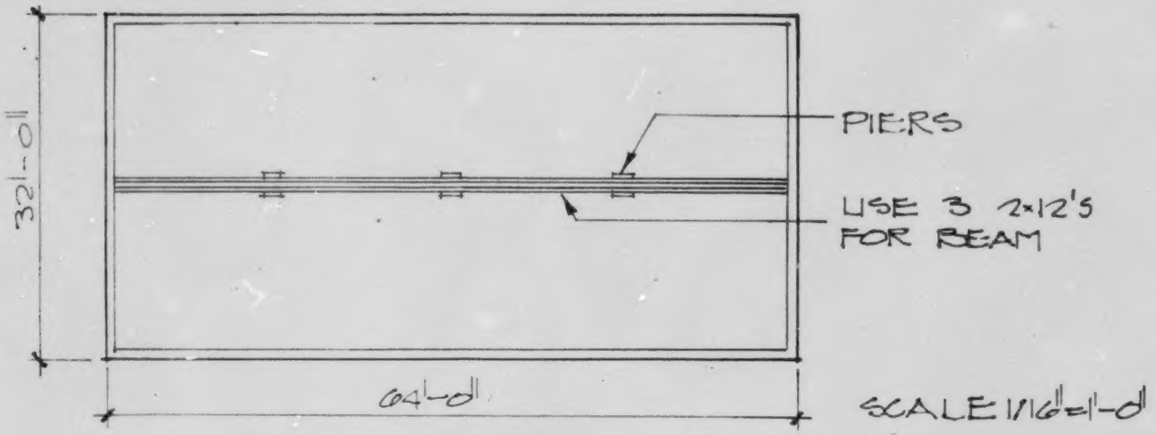
Framing Procedure for Parallel Floor Joists


8'-0"
4'-0"
2×10 FLOOR JOIST
9'-4"
SCALE: 3/8"=1'-0"

FLOOR AND SILL FRAMING
UNIT I

ASSIGNMENT SHEET #1--MATERIAL ESTIMATING (FLOOR AND SILL)

Using the information sheet, calculate the floor and sill material needed for the house depicted below.



1. Sill sealer (linear feet) ____________________
2. Termite shield (linear feet) ____________________
3. Sill (board feet 2 x 6) ____________________
4. Beams or girders (board feet 2 x 12) ____________________
5. Joists (board feet 2 x 8, 16" on centers) ____________________
6. Joist headers (board feet 2 x 8) ____________________
7. Bridging
   - a. Wood (board feet 1 x 4) ____________________
   - b. Steel (no. of pieces) ____________________
   - c. Solid lumber (linear feet) ____________________
8. Subflooring
   - a. Lumber (board feet 1 x 6 square edge laid diagonally) ____________________
   - b. Plywood (number of pieces 5/8" x 4' x 8' laid at right angles) ____________________

ASSIGNMENT SHEET #1

9. Nails
    a. 16d ________________________________
    b. 8d
        1) Bridging ________________________________
        2) Lumber subfloor ________________________________
        3) Plywood subfloor ________________________________

FLOOR AND SILL FRAMING
UNIT I

ANSWERS TO ASSIGNMENT SHEET #1

1. 192 linear feet
2. 192 linear feet
3. 192 board feet of 2 x 6 x 16'
4. 384 board feet of 2 x 12 x 16'
5. 2,091 board feet of 2 x 8 x 16'
6. 171 board feet of 2 x 8 x 16'
7. a. 86 board feet of 1 x 4
   b. 192 metal bridging
   c. 128 linear feet
8. a. 2,397 board feet of 1 x 6
   b. 2,048 square feet or 64 pieces of 4' x 8' plywood
9. a. 16d box nails--25 pounds
   b. 8d box nails
      1) 2 pounds for bridging
      2) 77 pounds for solid lumber
      3) 21 pounds for plywood

FLOOR AND SILL FRAMING
UNIT I

JOB SHEET #1--BUILD A BOX SILL AND INSTALL A FLOOR JOIST

I. Tools and materials

A. Tools

1. Electric handsaw
2. Electric hand drill
3. Flat bit, 5/8"
4. Tin snips
5. Claw hammer, 16 ounce or larger
6. Framing square
7. Level
8. Tape measure, 100 foot
9. Tape measure, 12 or 16 foot
10. Saber or reciprocating saw
11. Wrench, adjustable, 12"

B. Material

1. Sill sealer
2. Flashing for termite shield
3. Beam material

   (NOTE: See specifications.)
4. 2 x 6's for sills
5. 2 x 10's for joist and headers

   (NOTE: See specifications.)
6. 1 x 4's or solid lumber for bridging
7. Nails
   a. 8d box nails for bridging
   b. 16d box nails for joist and headers

JOB SHEET #1

II. Procedure

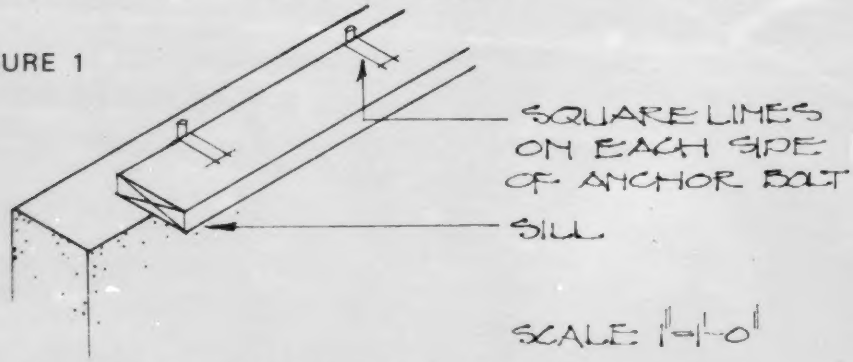
A. Check foundation for square and level

B. Strike lines on foundation

(NOTE: If foundation is not level, it may be necessary to use grout to level it.)

C. Lay 2 x 6 plate material on top of foundation according to picture below and mark the location of sill anchors (Figure 1)

FIGURE 1

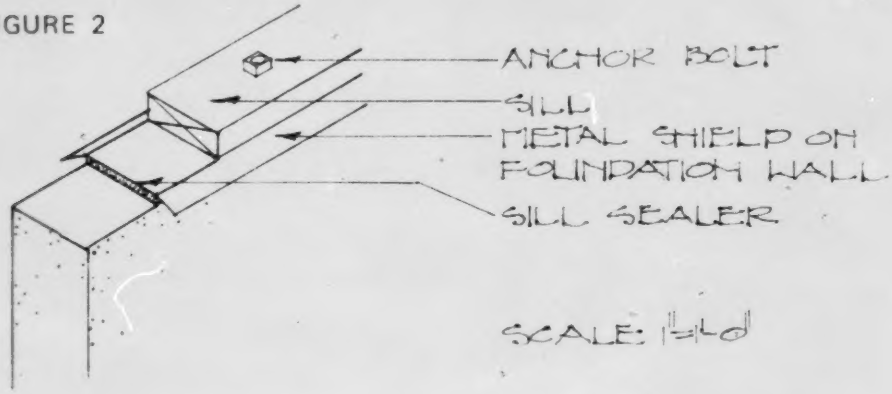

SQUARE LINES ON EACH SIDE OF ANCHOR BOLT
SILL
SCALE: 1"=1'-0"

D. Drill 5/8" holes through sill at anchor bolt locations

E. Cut sill sealer to length and lay on top of foundation

F. Cut flashing for termite shield to length, shape as in diagram below, cut holes for anchor bolts, and place on top of sill sealer (Figure 2)

FIGURE 2


ANCHOR BOLT
SILL
METAL SHIELD ON FOUNDATION WALL
SILL SEALER
SCALE: 1"=1'-0"

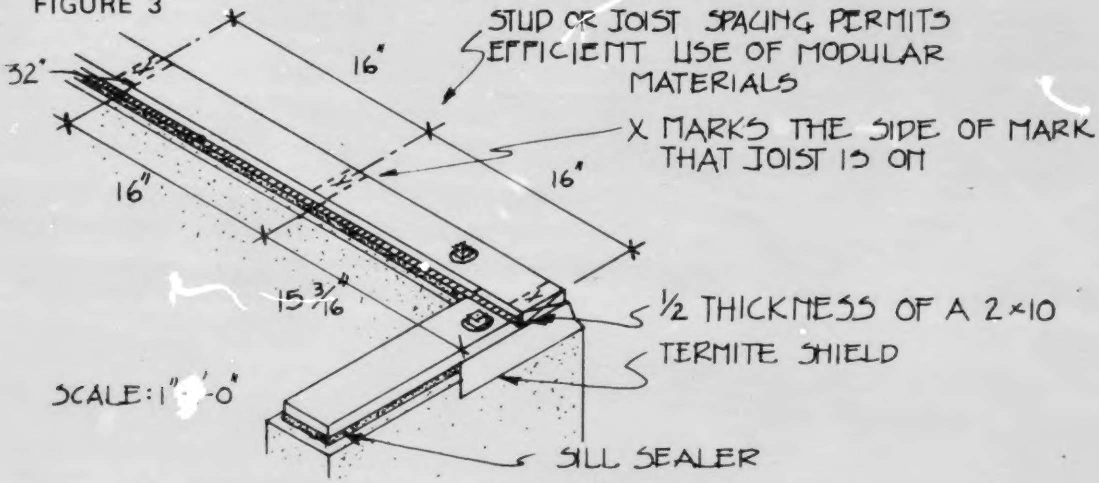
JOB SHEET #1

G. Lay off sill for floor joist on 16" centers

1. Start at one end using 100' tape marked on 16" centers

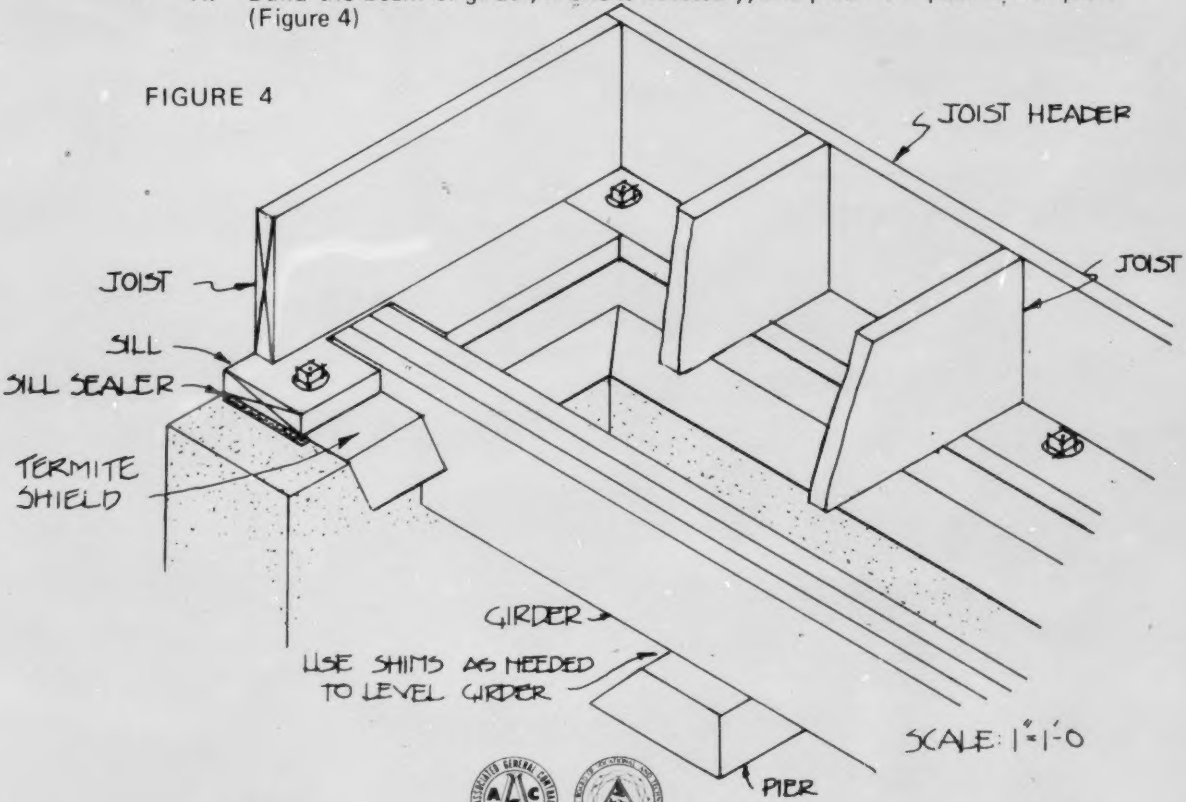
2. Hold the end of the tape 1/2 the thickness of a 2 x 10, past the end of the sill, and mark the sill every 16" for the full length, repeating the operation for the other side (Figure 3)

FIGURE 3


STUD OR JOIST SPACING PERMITS EFFICIENT USE OF MODULAR MATERIALS
X MARKS THE SIDE OF MARK THAT JOIST IS ON
32"
16"
16"
16"
15 3/16"
1/2 THICKNESS OF A 2×10
TERMITE SHIELD
SCALE: 1" = 1'-0"
SILL SEALER

H. Build the beam or girder, if one is necessary, and place it in position on piers (Figure 4)

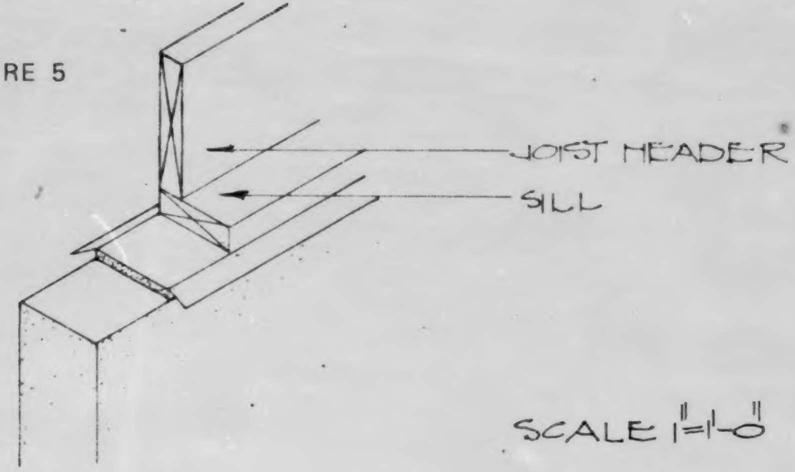
FIGURE 4


JOIST HEADER
JOIST
JOIST
SILL
SILL SEALER
TERMITE SHIELD
GIRDER
USE SHIMS AS NEEDED TO LEVEL GIRDER
SCALE: 1" = 1'-0
PIER

JOB SHEET #1

I. Cut to length and toe nail joist headers to sill to form a box sill using 16d box nails (Figure 5)

FIGURE 5


JOIST HEADER
SILL
SCALE 1"=1'-0"

J. Place sill and box sills on top of termite shield all around the perimeter of the structure

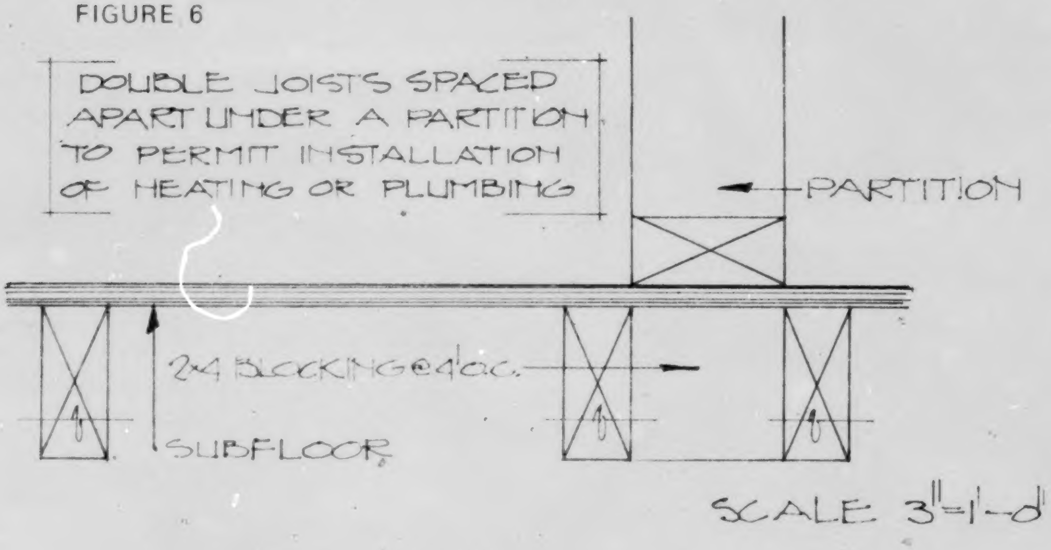
(NOTE: Before bolting down solid, check for squareness.)

K. Bolt sill in place

L. Distribute floor joists at every spot marked on the sill and add an extra one under each partition wall that runs parallel to the joist (Figure 6)

(NOTE: Sight along the edge of each joist and lay down on sill with the crown up.)

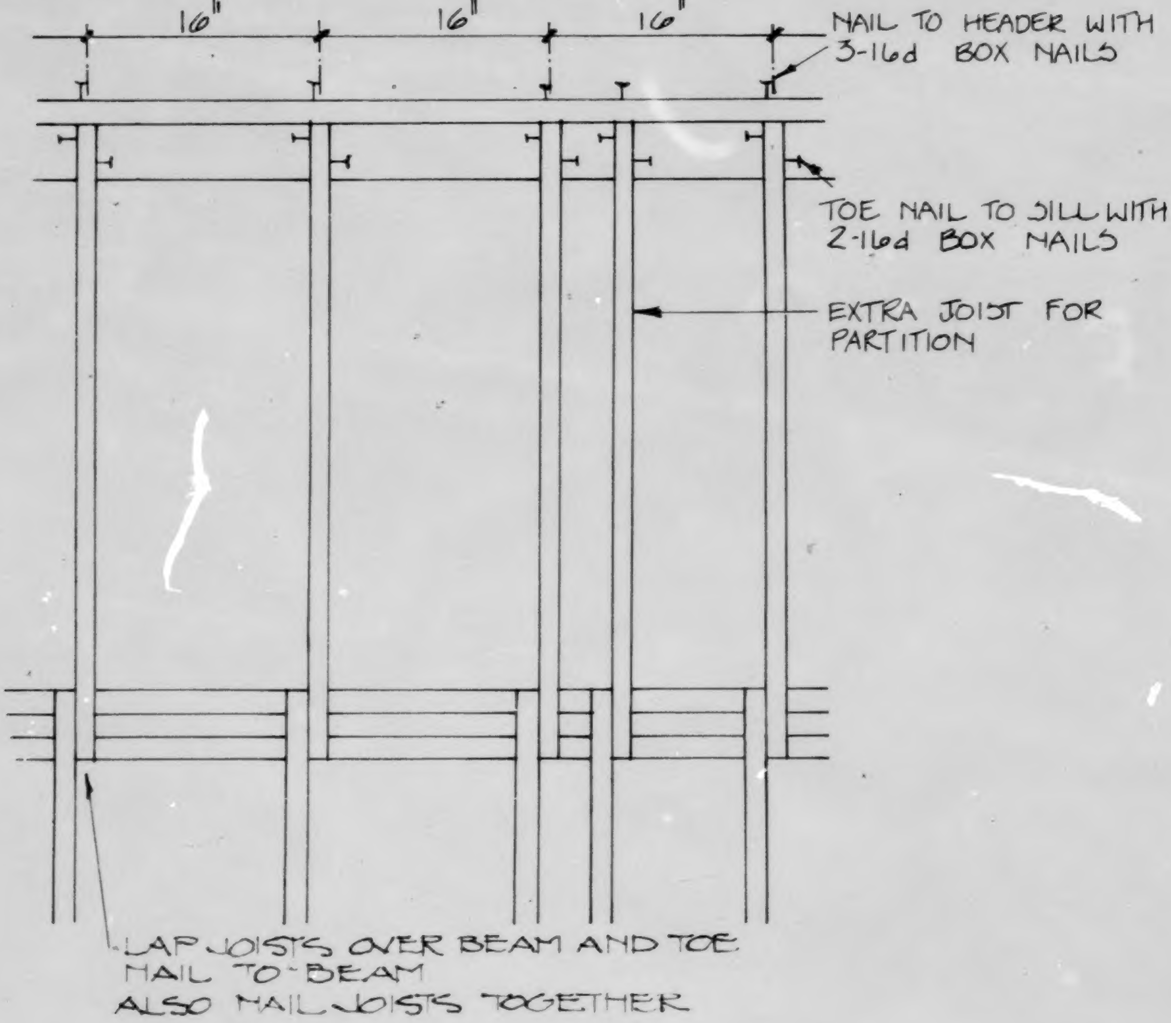
FIGURE 6


DOUBLE JOISTS SPACED APART UNDER A PARTITION TO PERMIT INSTALLATION OF HEATING OR PLUMBING
PARTITION
2×4 BLOCKING @ 4' O.C.
SUBFLOOR
SCALE 3"=1'-0"

JOB SHEET #1

M. Place joist on position marked on sill and nail in place (Figure 7)

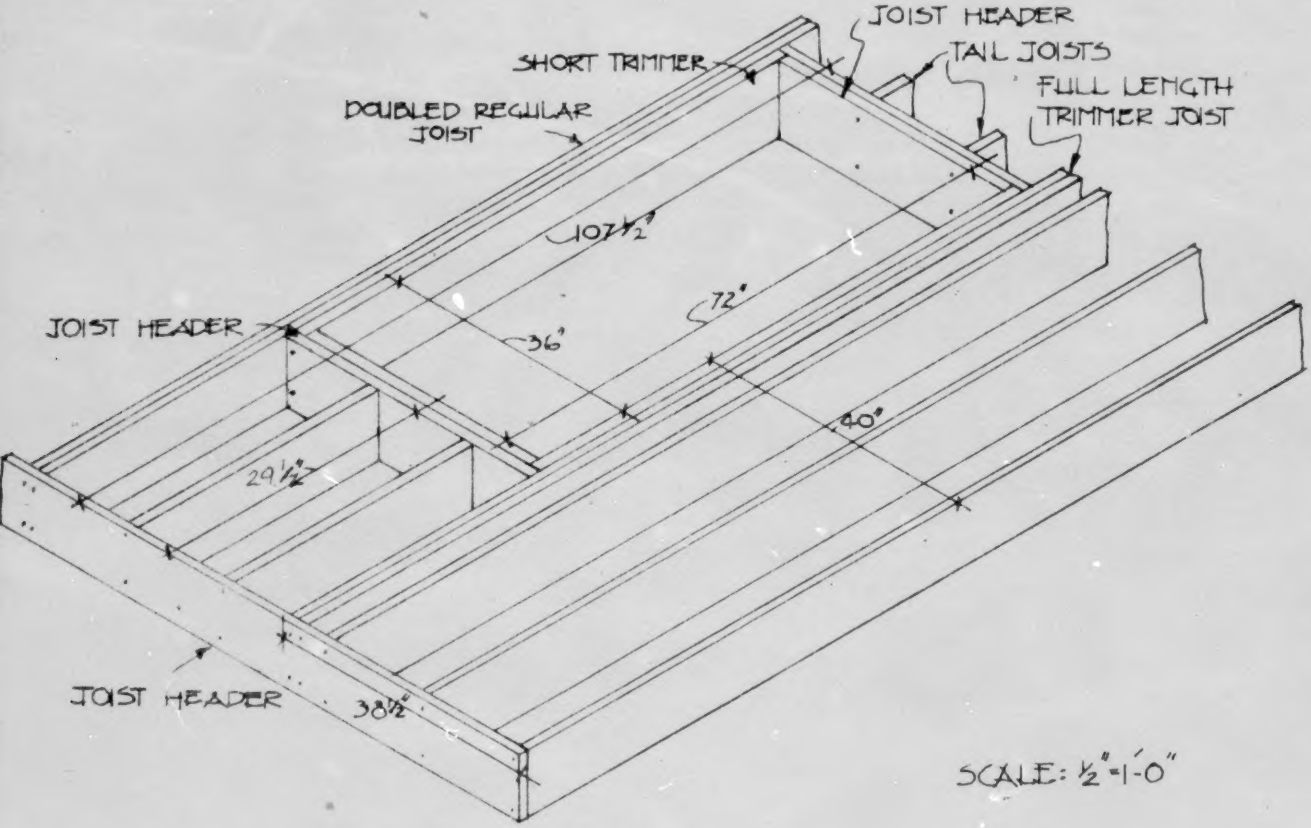
FIGURE 7


16"
16"
16"
NAIL TO HEADER WITH 3-16d BOX NAILS
TOE NAIL TO SILL WITH 2-16d BOX NAILS
EXTRA JOIST FOR PARTITION
LAP JOISTS OVER BEAM AND TOE NAIL TO BEAM
ALSO NAIL JOISTS TOGETHER

JOB SHEET #1

N. Frame openings in floor 36" x 72"; come in 40" from side and 31" from end (Figure 8)

FIGURE 8


JOIST HEADER
TAIL JOISTS
FULL LENGTH TRIMMER JOIST
SHORT TRIMMER
DOUBLED REGULAR JOIST
107 1/2"
72"
36"
JOIST HEADER
40"
29 1/2"
JOIST HEADER
38 1/2"
SCALE: 1/2"=1'-0"

1. Measure in 38 1/2" along header joist and mark
2. Install full length trimmer joist at this point
3. Cut off fourth and fifth regular joists at 29 1/2" and at 107 1/2"
4. Cut two joist headers to fit snugly between the full length trimmer and the regular joist
5. Nail headers to the tail joist at both ends and through the trimmer joist and regular joist into the headers
6. Cut two short joists 75" long and nail in place against regular joist and trimmer joist

JOB SHEET #1

7. Cut trimmer joist to full length and nail to first full trimmer, making it a double joist
8. Cut regular joist to full length and nail to other regular joist, making it a double joist
9. Allow plumbing and heating contractor to rough in gas, water, and forced air ducts

FLOOR AND SILL FRAMING
UNIT I

JOB SHEET #2--INSTALL BRIDGING

I. Tools and materials

  A. Tools

    1. Table saw or radial arm saw
    2. Framing square
    3. Claw hammer, 16 ounce or larger
    4. Tape, 12 or 16 foot

  B. Materials

    1. 1 x 4 lumber for **X** bridging
    2. Lumber the same size as the joists for solid bridging
    3. Steel bridging for steel **X** bridging
    4. Nails, 8d box

II. Procedure

  A. Wood **X** bridging

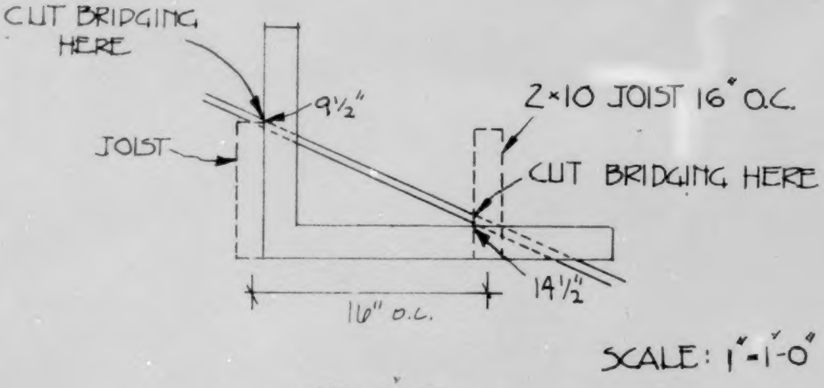
    1. Figure the number of pieces of bridging needed

       (NOTE: Use information sheet.)

    2. Lay out and cut bridging (Figure 1)

       (NOTE: Use the framing square and lay out the bridging as illustrated below.)

FIGURE 1

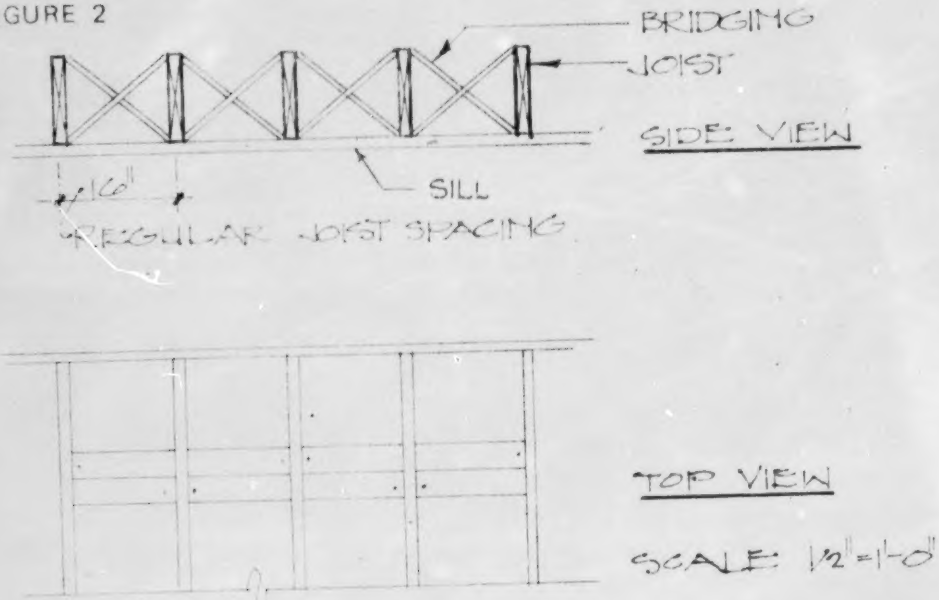

CUT BRIDGING HERE
9½"
2×10 JOIST 16" O.C.
JOIST
CUT BRIDGING HERE
14½"
16" o.c.
SCALE: 1"-1'-0"

JOB SHEET #2

3. Install bridging (Figure 2)

(NOTE: Nail only top end at this time.)

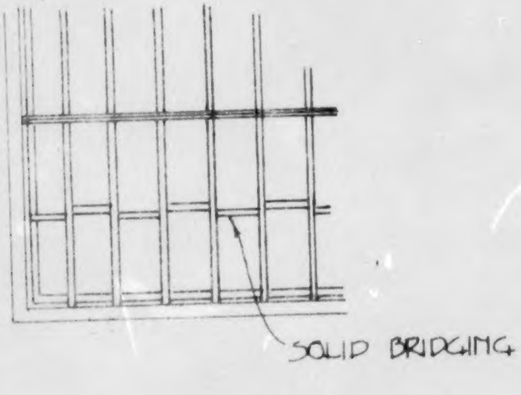
FIGURE 2


BRIDGING
JOIST
SIDE VIEW
16"
SILL
REGULAR JOIST SPACING
TOP VIEW
SCALE: 1/2"=1'-0"

B. Solid lumber bridging

1. Figure the number of pieces of bridging needed
2. Cut bridging
3. Install bridging in a staggered pattern to facilitate nailing (Figure 3)

FIGURE 3


SOLID BRIDGING

JOB SHEET #2

C. Steel **X** bridging (Figure 4)

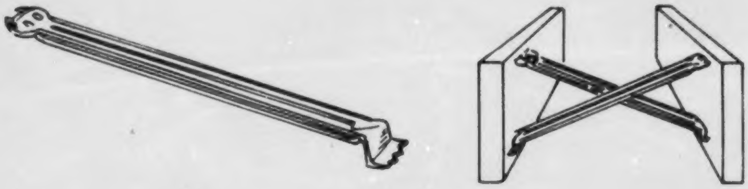
1. Figure the number of pieces needed

   (NOTE: Use information sheet.)

2. Install bridging (Figure 5)

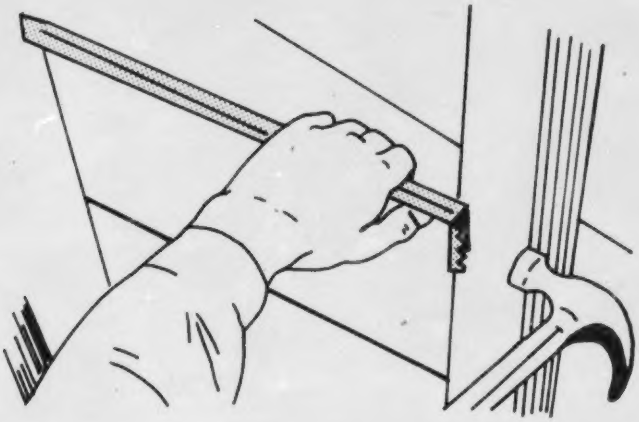
   (NOTE: Follow manufacturer's instructions.)

FIGURE 4



Steel bridging and completed installation.

FIGURE 5



Method of installation

FLOOR AND SILL FRAMING
UNIT I

JOB SHEET #3--LAY A SUBFLOOR

I. Tools and materials

   A. Tools

      1. Electric handsaw

      2. Electric hand drill

      3. Assorted flat bits

      4. Claw hammer, 16 ounce or larger

      5. Framing square

      6. Tape, 12 or 16 foot

      7. Saber or reciprocating saw

   B. Material

      1. For lumber laid at a diagonal

         a. Enough 1 x 6 or 1 x 8 lumber to cover floor area

         b. Nails, 8d box

      2. For lumber laid at right angles

         a. Enough 1 x 6 or 1 x 8 lumber to cover floor area

         b. Nails, 8d box

      3. For plywood subfloor

         a. Enough plywood to cover floor area

         b. Nails, 8d box

II. Procedure for installing subfloor

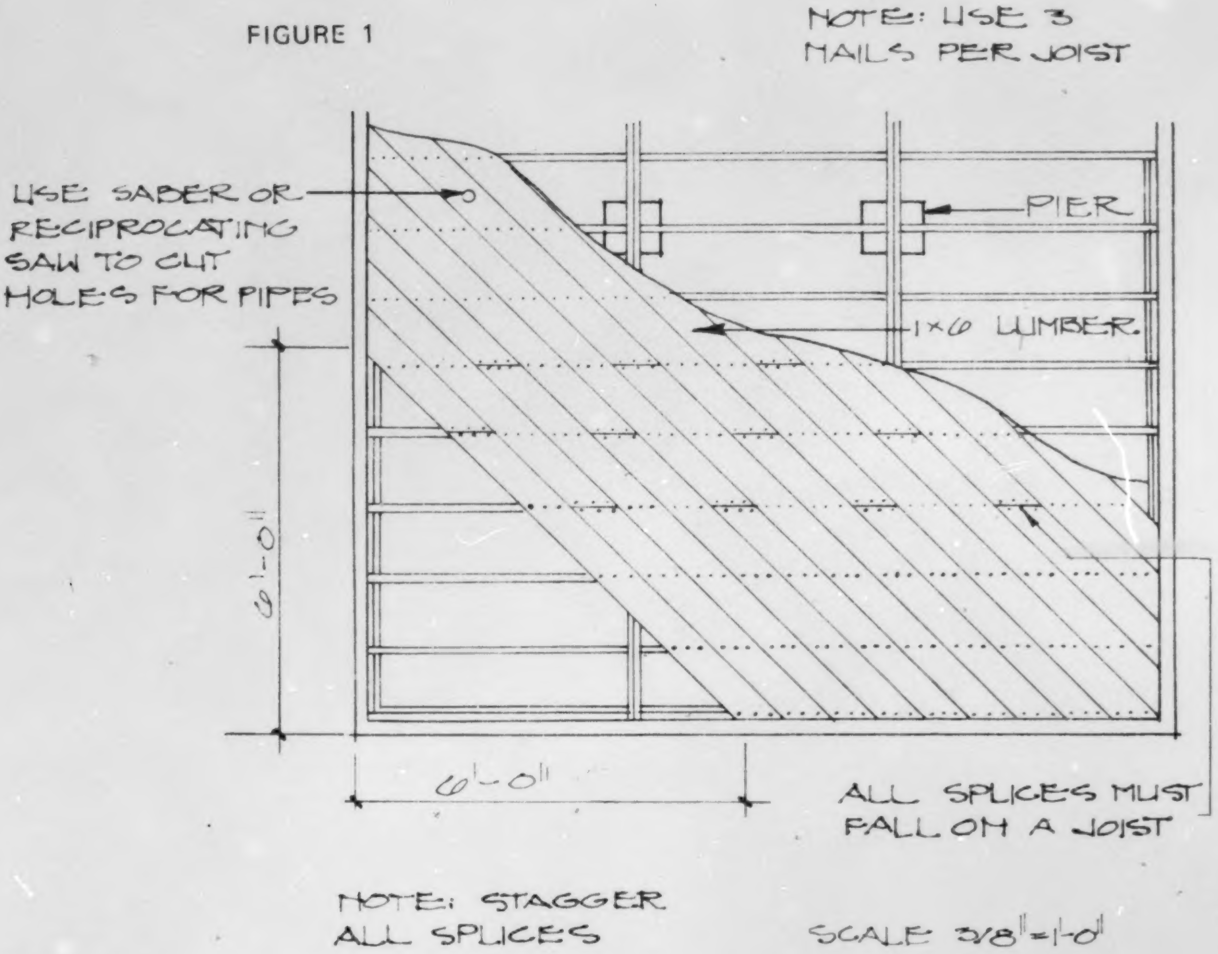
   A. Lay lumber diagonal to joist

JOB SHEET #3

1. Measure both ways from one corner to about 6' each direction and lay the first board (Figure 1)

   (NOTE: Use 3 - 8d box nails per joist for 1 x 6 lumber and 3 - 8d box nails per joist for 1 x 8 lumber. See Figure 1.)

FIGURE 1


NOTE: USE 3
NAILS PER JOIST
USE SABER OR RECIPROCATING SAW TO CUT HOLES FOR PIPES
PIER
1×6 LUMBER
6'-0"
6'-0"
ALL SPLICES MUST FALL ON A JOIST
NOTE: STAGGER ALL SPLICES
SCALE 3/8"=1'-0"

2. Lay the remainder of the subflooring and nail in place as illustrated above

   (NOTE: Ends may be allowed to run wild over the header joist and trimmed later.)

B. Lay lumber at right angles to joist

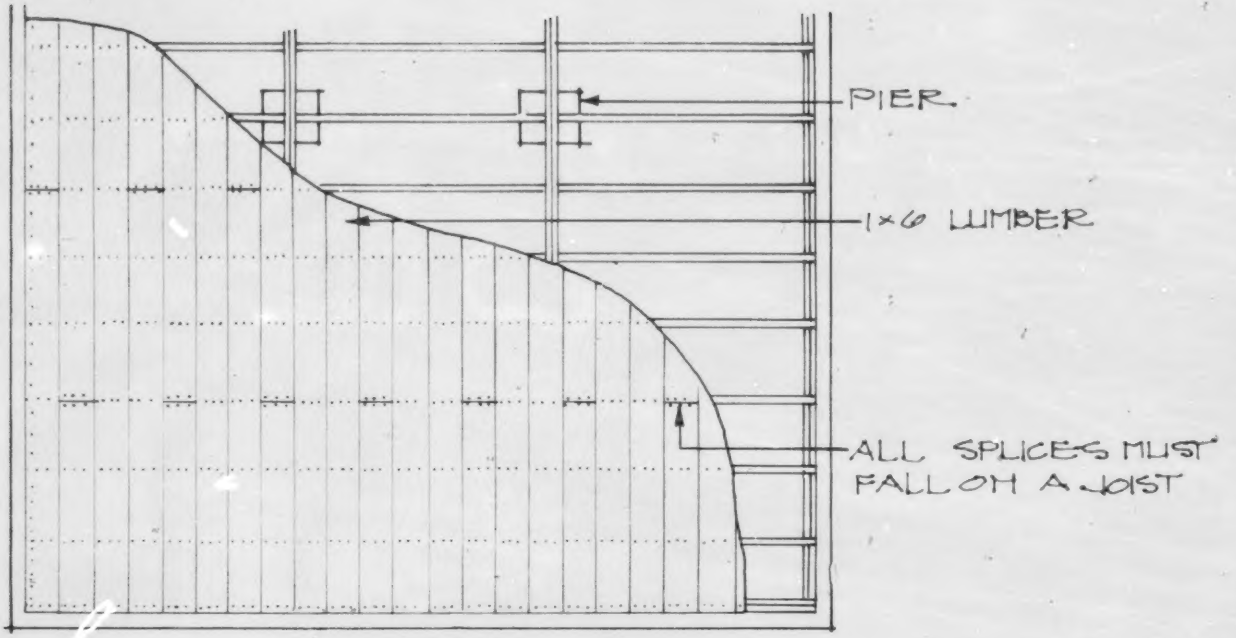
1. Start at corner from which the joist was laid off

JOB SHEET #3

2. Lay subfloor (Figure 2)

(NOTE: Tongue and groove 1 x 6 can also be used.)

FIGURE 2


PIER
1×6 LUMBER
ALL SPLICES MUST FALL ON A JOIST

SCALE 3/8" = 1'-0"

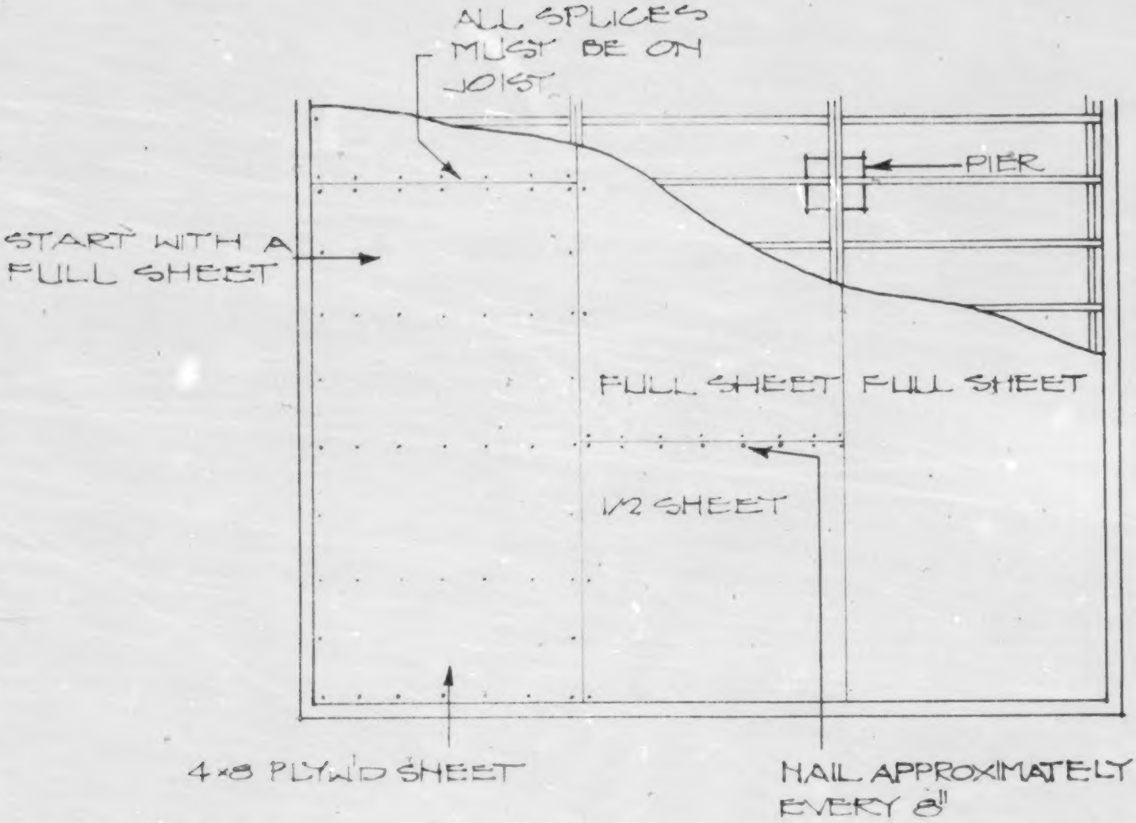
(NOTE: Stagger all splices.)

JOB SHEET #3

C. Lay plywood at right angles (Figure 3)

(NOTE: With tongue and groove plywood or ply clips, joints do not need to be on joist.)

FIGURE 3


ALL SPLICES MUST BE ON JOIST
PIER
START WITH A FULL SHEET
FULL SHEET
FULL SHEET
1/2 SHEET
4×8 PLYW'D SHEET
NAIL APPROXIMATELY EVERY 8"

NOTE: USE 8D BOX NAILS

SCALE 3/8" = 1'-0"

FLOOR AND SILL FRAMING
UNIT I

JOB SHEET #4--INSTALL FLOOR JOISTS FOR CANTILEVER FLOOR

I. Tools and materials

   A. Tools

      1. Electric handsaw
      2. Claw hammer, 16 oz or larger
      3. Framing square
      4. Level
      5. Tape, 12 or 16 ft
      6. Tape, 100 ft

   B. Materials

      1. 2 x 10's for joists and headers
      2. Nails

         a. 8d box

         b. 16d box

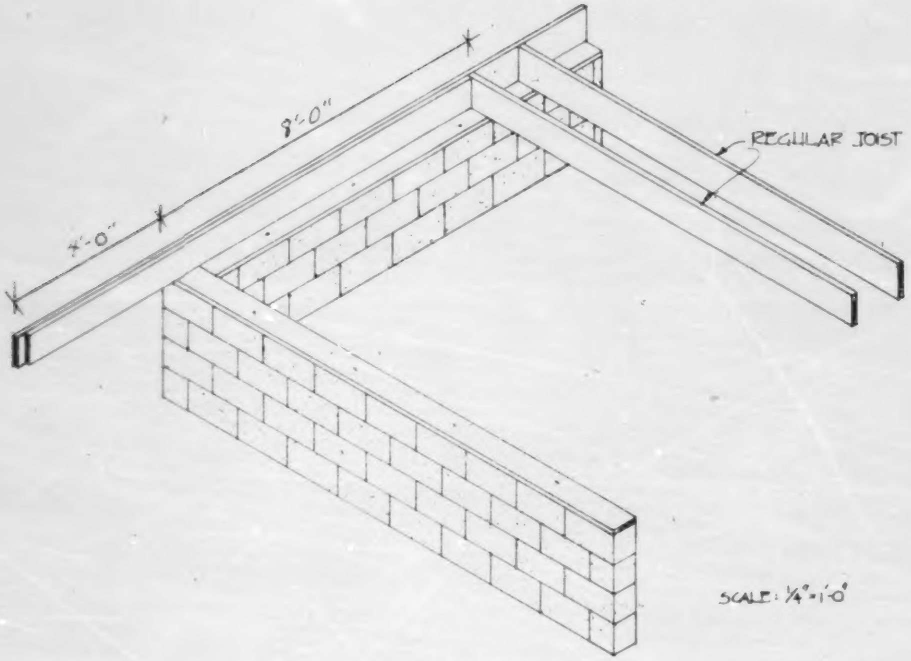
II. Procedure for parallel floor joist

(NOTE: The framing procedure for parallel floor joists is comparatively simple. All you do is use longer floor joists and extend them out the length of the projection, keeping in mind that the joist should extend inward a distance equal to at least twice the overhang. See Transparency 12.)

JOB SHEET #4

A. Begin by doubling the first joist (Figure 1)

FIGURE 1



B. Measure, cut, and nail in double joist on opposite end

(NOTE: It may be necessary to notch top of all cantilever joists so that deck will be slightly lower than the door sill.)

C. Measure across header and mark end joist location at opposite end; also mark same location on plate

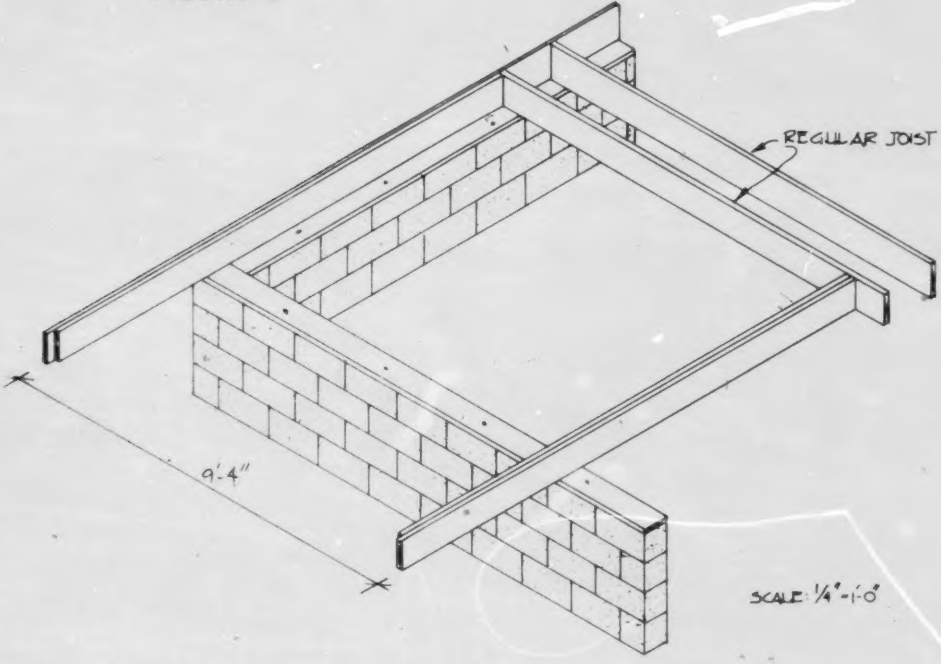
JOB SHEET #4

D. Measure and cut two joists for double joist

(NOTE: Inside joist will be 1 1/2" shorter to receive header. Nail these together before installing.)

E. Nail double joist in place at marked location (Figure 2)

FIGURE 2



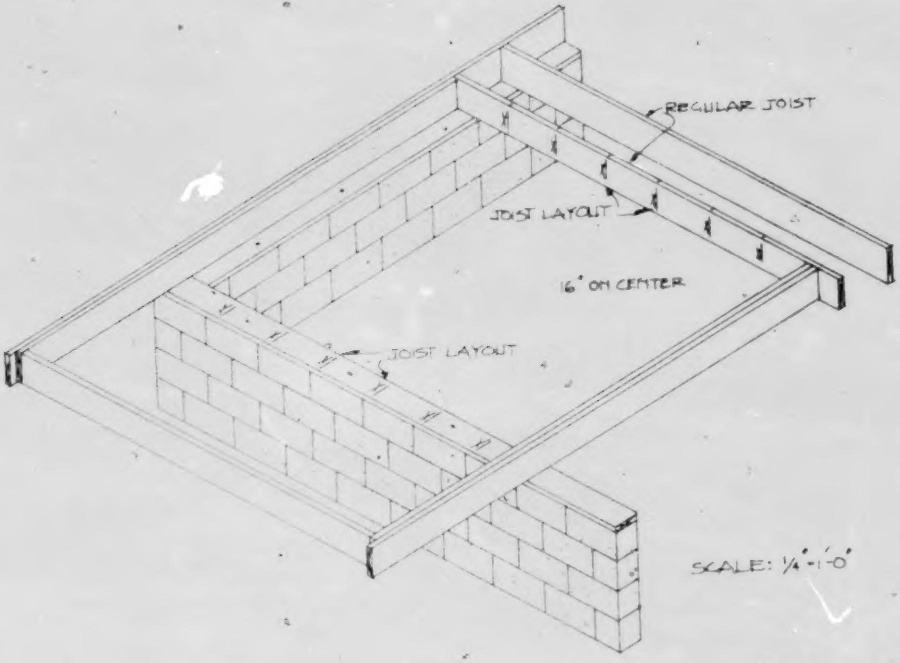
F. Lay out joist 16" o.c. at both ends

G. Measure and cut header to fit between two short joists

JOB SHEET #4

H. Nail in header (Figure 3)

FIGURE 3


REGULAR JOIST
JOIST LAYOUT
16" ON CENTER
JOIST LAYOUT
SCALE: 1/4"-1'-0"

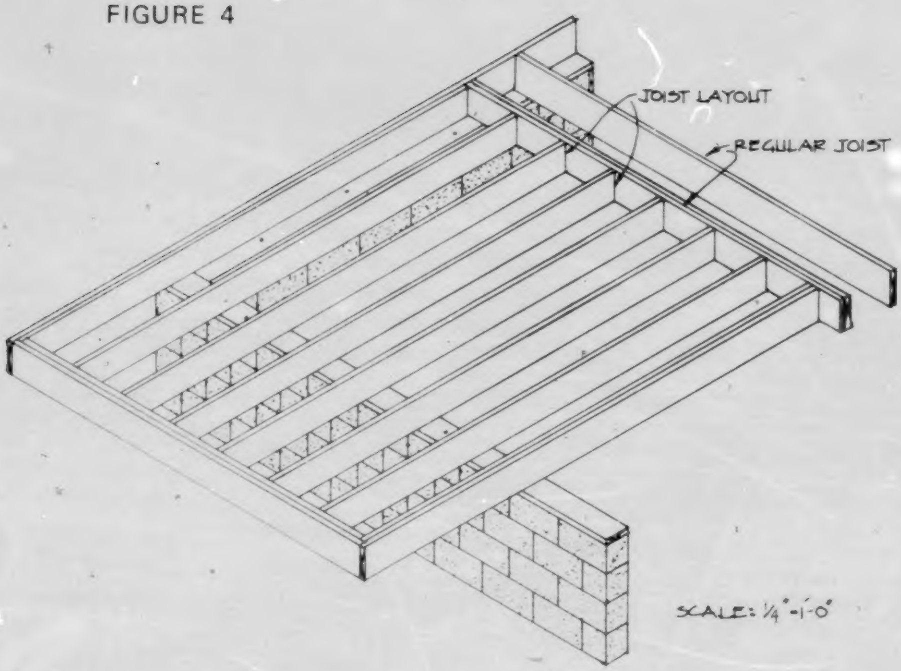
I. Measure, cut, and then nail in remainder of joists

(NOTE: Joists, spacing, and size depend on size of deck and provide for carrying the live loads.)

JOB SHEET #4

J. Measure, cut, and nail in double header on both ends (Figure 4)

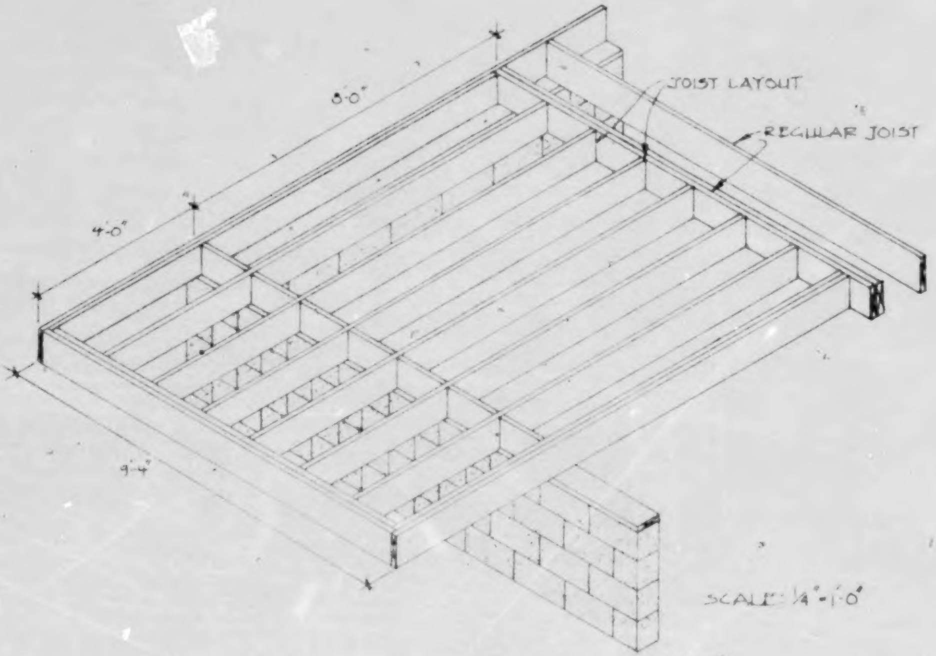
FIGURE 4


JOIST LAYOUT
REGULAR JOIST
SCALE: 1/4"-1'-0"

JOB SHEET #4

K. Use solid blocking to block between joists at building line (Figure 5)

FIGURE 5


8'-0"
4'-0"
9'-4"
JOIST LAYOUT
REGULAR JOIST
SCALE: 1/4"=1'-0"

FLOOR AND SILL FRAMING
UNIT I

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Type of building construction in which the studs extend in one piece from the foundation to the roof

_____b. Any large piece of timber, stone, iron, or other material used to support concentrated loads at particular points along its length

_____c. Framing member into which the common joists are fitted forming the box sill; member used to support the free end of joists over openings, such as stairs and chimneys

_____d. Solid lumber or small wooden or steel pieces fitted in pairs from the bottom of one joist to the top of the adjacent joist and crossed to stiffen and help distribute the load

_____e. One of a series of parallel framing members used to support floor and ceiling loads and supported, in turn, by beams or girders

_____f. Supporting portion of a structure below the first floor construction including the footings

_____g. Shield, usually made of sheet metal, placed on a foundaton wall or around pipes to prevent the passage of termites into the structure

_____h. Relating to the high side of the crook in framing lumber

_____i. System of framing a building where the floor joists of each story rest on the top plates of the story below, and the bearing walls and partitions rest on the subfloor of each story

1. Beam or girder
2. Bridging
3. Crown
4. Foundation
5. Joist header
6. Joist
7. Balloon framing
8. Termite shield
9. Sill
10. Sill sealer
11. Subfloor
12. Western framing
13. Joist hangers

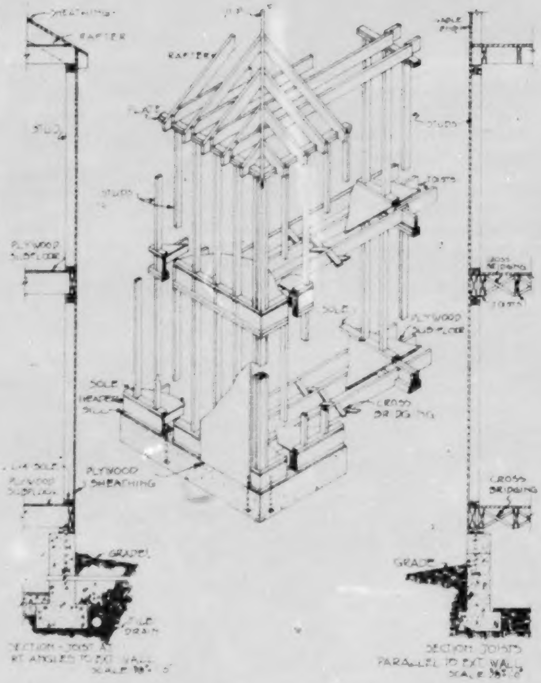
_____j. Lowest member of the frame of a structure resting horizontally on the foundation and supporting the uprights of the frame

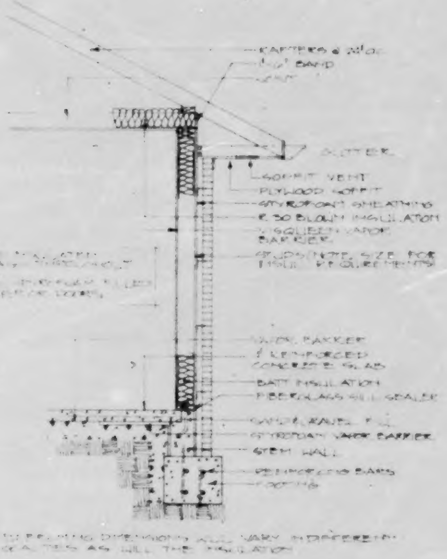
_____k. Boards or panels laid directly on the floor joists over which a finished floor will be laid

_____l. Resilient waterproof material used under the sills as a seal against air, dirt, and insects

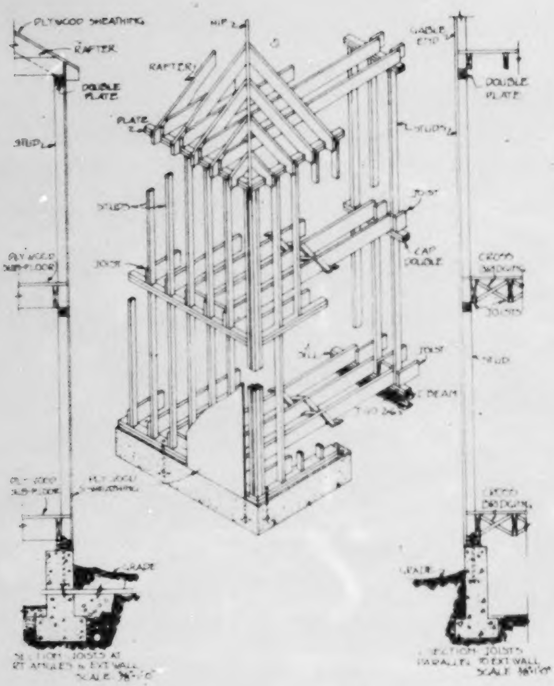
_____m. Metal saddles secured to face of girder in which joist ends rest

2. Identify the styles of framing shown below and on the next page. Write the correct names in the blanks provided.

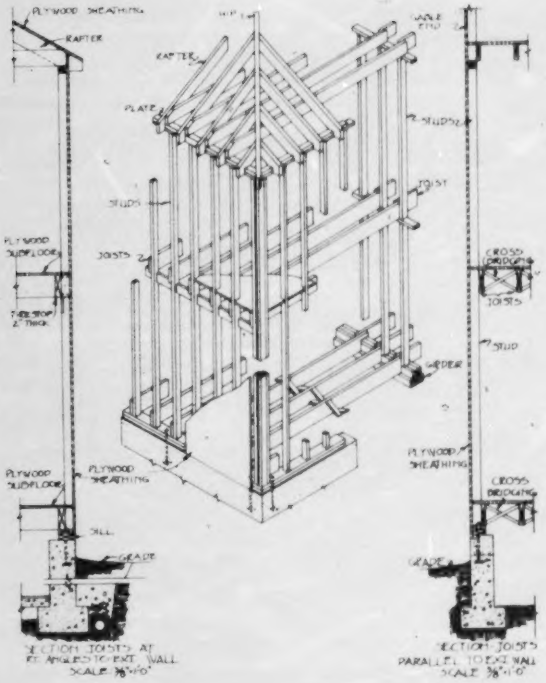

SHEATHING
RAFTER
RAFTERS
PLATE
STUD
STUDS
STUDS
JOISTS
PLYWOOD SUBFLOOR
CROSS BRIDGING
JOISTS
SOLE
PLYWOOD SUBFLOOR
SOLE
HEADER
SILL
CROSS BRIDGING
PLYWOOD SHEATHING
PLYWOOD SUBFLOOR
CROSS BRIDGING
GRADE
GRADE
TILE DRAIN
SECTION - JOIST AT RT. ANGLES TO EXT. WALL
SECTION JOISTS PARALLEL TO EXT. WALL


RAFTERS @ 24" O.C.
BAND
GUTTER
SOFFIT VENT
PLYWOOD SOFFIT
STYROFOAM SHEATHING
R-30 BLOWN INSULATION
VISQUEEN VAPOR BARRIER
STUDS (NOTE: SIZE FOR INSUL. REQUIREMENTS)
VAPOR BARRIER
REINFORCED CONCRETE SLAB
BATT INSULATION
FIBERGLASS SILL SEALER
SAND/GRAVEL FILL
STYROFOAM VAPOR BARRIER
STEM WALL
REINFORCING BARS
FOOTING

a. ______________________ b. ______________________


PLYWOOD SHEATHING
RAFTER
DOUBLE PLATE
STUD
PLYWOOD SUBFLOOR
PLYWOOD SUBFLOOR
PLYWOOD SHEATHING
GRADE
SECTION JOISTS AT RT ANGLES to EXT WALL SCALE 3/8"=1'0"
HIP
RAFTERS
PLATE
STUDS
JOIST
GABLE END
DOUBLE PLATE
STUDS
JOIST
CAP DOUBLE
CROSS BRIDGING
JOISTS
SILL
JOIST
STUD
BEAM
TWO 2x6
CROSS BRIDGING
GRADE
SECTION JOISTS PARALLEL TO EXT WALL SCALE 3/8"=1'0"

c. ______________________________


PLYWOOD SHEATHING
RAFTER
PLYWOOD SUBFLOOR
FIRE STOP 2" THICK
PLYWOOD SUBFLOOR
PLYWOOD SHEATHING
SILL
GRADE
SECTION JOISTS AT RT ANGLES TO EXT WALL SCALE 3/8"=1'0"
HIP
RAFTER
PLATE
STUDS
JOISTS
GABLE END
STUDS
JOIST
CROSS BRIDGING
JOISTS
STUD
GIRDER
PLYWOOD SHEATHING
CROSS BRIDGING
GRADE
SECTION JOISTS PARALLEL TO EXT WALL SCALE 3/8"=1'0"

d. ______________________________

3. Identify the framing members that make up the floor and sill.

a. ____

b. ____

c. ____

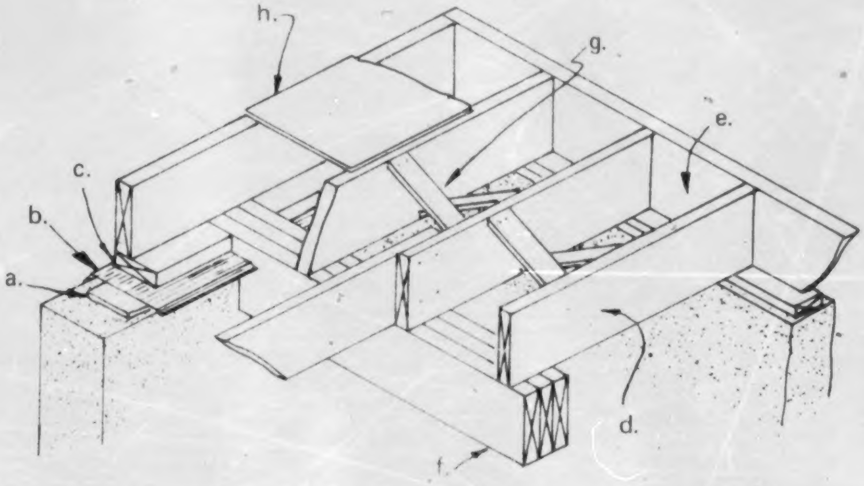
d. ____

e. ____

f. ____

g. ____

h. ____



4. State the purpose of a sill sealer.

____

____

5. State the purpose of a termite shield.

____

____

6. Name the methods of fastening sills to foundation walls.

a. ____

b. ____

7. State the purpose of bridging.

____

____

8. Name types of bridging.

a. ______________________________

b. ______________________________

c. ______________________________

9. State the purpose of beams or girders.

____

____

10. State the purpose of joist hangers.

____

____

11. List types of subflooring.

a. ______________________________

b. ______________________________

12. Match fasteners on the right to their uses by placing the appropriate numbers in the blanks provided. A blank may have more than one correct answer.

______a. Used to fasten joist to sill and headers to joist

______b. Used to anchor the sill to the foundation

______c. Used to fasten subfloor to joist

1. 8d box nails
2. Sill anchors
3. 16d box nails
4. Masonry nails

13. Estimate the amount of material needed to frame a floor and sill and to lay a subfloor.

a. Estimate the amount of material needed to frame a floor and sill for a building 54' x 28' using 2 x 6's and plywood.

1) Sill--

2) Floor--

(NOTE: Room for figuring has been provided on the next page.)

b. Estimate the number of sheets of 4' x 8' plywood needed to subfloor a house 68' long by 36' wide.

14. Demonstrate the ability to:

    a. Build a box sill and install a floor joist.

    b. Install bridging.

    c. Lay a subfloor.

    d. Install floor joists for cantilever floor.

    (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

FLOOR AND SILL FRAMING
UNIT I

ANSWERS TO TEST

1. a. 7
   b. 1
   c. 5
   d. 2
   e. 6
   f. 4
   g. 8
   h. 3
   i. 12
   j. 9
   k. 11
   l. 10
   m. 13

2. a. Modern braced framing
   b. Framing adaptions for saving energy
   c. Western or platform framing
   d. Balloon framing

3. a. Sill sealer
   b. Termite shield
   c. Sill
   d. Joist
   e. Joist header
   f. Beam or girder
   g. Bridging
   h. Subfloor

4. Provides a seal against air, dirt, and insects
5. Prevents the passage of termites to the structure
6. a. Sill anchor
    b. Concrete nail
7. Stiffens and helps distribute the load
8. a. Solid lumber bridging
    b. Lumber **X** bridging
    c. Adjustable steel **X** bridging
9. Support concentrated loads at particular points along their lengths
10. Support the ends of the joist
11. a. Lumber
    b. Plywood
12. a. 3
    b. 2, 4
    c. 1
13. a. 1) Sill--164 board feet
        2) Floor--41 pieces 5/8" x 4' x 8' CD, exterior grade, fir plywood
    b. 77 sheets
14. Performance skills evaluated to the satisfaction of the instructor

WALL AND PARTITION FRAMING
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify framing members and compute the length of common members. The student should also be able to lay out, cut, and assemble a wall section and name and install types of sheathing. This knowledge will be evidenced by completion of the assignment sheet, job sheets, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match a list of terms associated with wall and partition framing to the correct definitions.
2. Identify the framing members used in wall and partition construction.
3. Compute the length of the regular stud.
4. Compute the length of trimmers for window and door openings.
5. Compute the length of the rough header for windows and doors.
6. Name types of sheathing.
7. Estimate the amount of materials needed for wall and partition framing.
8. Demonstrate the ability to:
    a. Lay out wall and partition locations on floor.
    b. Cut studs, trimmers, cripples, and headers to length.
    c. Build corners, T's, and headers.
    d. Construct wall sections for a single-story structure.
    e. Install sheathing.
    f. Lay out and install ceiling joists.
    g. Install windows.
    h. Install exterior door frame and hang door.

WALL AND PARTITION FRAMING
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information, assignment, and job sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information and assignment sheets.

  F. Demonstrate and discuss procedures outlined in job sheets.

  G. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Wall and Partition Framing Members
    2. TM 2--Corners
    3. TM 3--Corners (Continued)
    4. TM 4--Partition T's
    5. TM 5--Partition T's (Continued)
    6. TM 6--Partition T's (Continued)
    7. TM 7--Partition T's (Continued)
    8. TM 8--Stud Length for a Slab Floor
    9. TM 9--Stud Length for a Wood Floor
    10. TM 10--Trimmer Studs
    11. TM 11--Door and Window Headers
    12. TM 12--Types of Sheathing
    13. TM 13--Types of Sheathing (Continued)

D. Assignment Sheet #1--Material Estimating

E. Answers to assignment sheet

F. Job sheets

1. Job Sheet #1--Lay Out Wall and Partition Locations on Floor
2. Job Sheet #2--Cut Studs, Trimmers, Cripples, and Headers to Length
3. Job Sheet #3--Build Corners, T's, and Headers
4. Job Sheet #4--Construct Wall Sections for a Single-Story Structure
5. Job Sheet #5--Install Sheathing
6. Job Sheet #6--Lay Out and Install Ceiling Joists
7. Job Sheet #7--Install Windows
8. Job Sheet #8--Install Exterior Door Frame and Hang Door

G. Test

H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

B. Cooper, George H., and Badzinski, Stanley Jr. *Building Construction Estimating.* St. Louis, Missouri: McGraw-Hill, 1971.

C. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry.* 3rd ed. Chicago: American Technical Society, 1963.

D. *Suggested Basic Course Outline in Carpentry.* Stillwater: Oklahoma State Department of Vocational and Technical Education, Trade and Industrial Education.

E. Smith, Ronald C. *Principles and Practices of Light Construction.* Englewood Cliffs, New Jersey: Prentice Hall Inc., 1970.

F. Wagner, Willis H. *Modern Carpentry.* Homewood, Illinois: Goodheart-Willcox, 1969.

G. Hendrix, Laborn J. "Bud," and Patton, Bob. *Construction Craftsman's Curriculum.* Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and Associated General Contractors of America, 1978.

WALL AND PARTITION FRAMING
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Bearing wall--Wall which supports the floors and/or roof directly above it in addition to its own weight

B. Blocking--Use of wood blocks as filler pieces between framing members

C. Cripple stud--Any part of a framing stud that is cut less than full size, as over a door or window opening and under a window opening

D. Double plate--Topmost member of a wall section attached to the top of the studs for the purpose of stiffening the wall and for tying together splices, corners, and partitions that are at right angles to a wall

E. Header--Horizontal structural member that supports the load over an opening, such as a window or door

F. Partition--Wall that subdivides space within a building

G. Rough opening--Opening for doors and windows formed by the framing members

H. Rough sill--Lower framing member which is attached to the top of the bottom cripple studs and forms the base of a rough opening for a window

I. Sole plate--Lowest horizontal member of a wall or partition which rests on the rough floor to which the studding is nailed

J. Stud--Main vertical framing members in walls and partitions

K. Trimmer--Vertical members that form the sides of a rough opening for a door or window upon which the header rests

L. Jamb--Top and two sides of a door or window frame which contact the door or sash, consisting of a head jamb and two side jambs

M. Spacer--Usually a 2 x 4 about 16" long used as a spacer between studs to form corners and partition T's

N. Gable--End of building; triangular end of an exterior wall above the eaves

O. Bearing partition--Partition wall that supports the structure above

INFORMATION SHEET

P. Sheathing--Various types of material designed to use on exterior of a structure

II. Wall and partition framing members (Transparency 1)

- A. Sole plate
- B. Regular stud
- C. Top plate
- D. Trimmer stud
- E. Header
- F. Cripple stud
- G. Rough sill
- H. Double top plate
- I. Corner assembly
- J. Blocking

III. Computing the length of the regular stud

A. Slab floor (Transparency 8)

1. Determine the height of the finished ceiling from the finished floor including one-half inch clearance for finish material

2. Determine the thickness of the sole plate plus the double top plate

3. Determine the thickness of ceiling material and flooring material

   (NOTE: For carpet or a resilient type flooring material, the thickness is negligible.)

4. Add the thickness of ceiling and flooring material to the finished ceiling height

5. Subtract the thickness of the plates from the sum achieved in step number four for the stud length

INFORMATION SHEET

Example: When the desired finished ceiling height is 8'-1/2" the actual plate thickness is 1 1/2", and the ceiling thickness is 1/2"

Step #1--Finished ceiling height = 8' + 1/2" = 8'-1/2"

	Sole Plate		Top Plate		Double Top Plate	
Step #2--	1 1/2"	+	1 1/2"	+	1 1/2"	= 4 1/2"

	Finished Ceiling Height		Thickness of Ceiling	
Steps #3 and #4--	8'-1/2"	+	1/2"	= 8'-1"

Step #5-- 8'-1" - 4 1/2" = 7'-8 1/2" Stud Length

B. Wood floor (Transparency 9)

1. Determine the height of the finished ceiling from the finished floor including 1/2" clearance for finish material
2. Determine the thickness of the sole plate plus the double top plate
3. Determine the thickness of ceiling material and underlayment
4. Add the thickness of ceiling and underlayment to the finished ceiling height
5. Subtract the thickness of the plates from the sum achieved in step number four for the stud length

Example: When the desired finished ceiling height is 8'-1/2", the actual plate thickness is 1 1/2", the ceiling thickness is 1/2", and the underlayment thickness is 5/8"

Step #1--Finished ceiling height - 8'-1/2"

	Sole Plate		Top Plate		Double Top Plate	
Step #2--	1 1/2"	+	1 1/2"	+	1 1/2"	= 4 1/2"

	Finished Ceiling Height		Thickness of Ceiling Material		Thickness of Underlayment	
Step #3 and #4--	8'-1/2"	+	1/2"	+	5/8"	= 8'-1 5/8"

Step #5-- 8'-1 5/8" - 4 1/2" = 7'-9 1/8" Stud Length

INFORMATION SHEET

IV. Computing the length of trimmers for window and door openings (Transparency 10)

(NOTE: The tops of all windows and doors should be the same height from the floor unless otherwise specified. To compensate for variation in materials, the top of the trimmers may be scribed.)

A. Slab floor

1. Determine the height of the rough opening from the finished floor
2. Determine the door height and add 5/8" for clearance at the bottom of the door

   (NOTE: Standard doors are 6'-8" high.)
3. Add 3/4" for jamb header
4. Add 3/4" for clearance between rough header and jamb header
5. Subtract the thickness of the sole plate and the result is the trimmer stud length

Example:	Door height and	6'-8"
	clearance	5/8"
	Jamb header	3/4"
	Header clearance	3/4"
		6'-10 1/8"
	Sole plate	- 1 1/2"
	Trimmer stud length	6'- 8 5/8"

B. Wood floor--Compute the same as for a slab floor remembering to add the thickness of the underlayment to establish the finished floor

(NOTE: To compensate for variation in materials, the top of the trimmers may be scribed.)

V. Computing rough header length for window and door openings (Transparency 11)

A. Rough header length for doors

(NOTE: If prehung doors are used, check manufacturer's specifications for rough opening size.)

1. Determine rough opening width
2. Check door schedule for door sizes
3. Add 1/4" to door width for clearance between door edges and jamb

INFORMATION SHEET

4. Add 1 1/2" for side jambs

5. Add 1" for clearance to install jambs

6. Add 3" to rough opening width for trimmer studs to get the header length

Example: For a 3'-0" x 6'-8" door

Door size	3'-0"
Door and jamb clearance	1/4"
Side jambs	1 1/2"
Side jamb and trimmer clearance	+ 1"
Rough opening	3'-2 3/4"
Thickness of trimmer studs	+ 3"
Header size	3'-5 3/4" or 41 3/4"

(NOTE: After computing one header size, subtract the door size from it and use this figure to add to other door sizes to determine header sizes.)

B. Rough header length for windows--Check with manufacturer to determine rough opening size and add the thickness of the two trimmer studs, also taking into account whether the return on metal windows is to be sheetrock or wood

VI. Types of sheathing (Transparencies 12 and 13)

A. Gyplap

B. Fiberboard

C. Plywood

D. Styrofoam

E. 1 x 6's (diagonal, horizontal, or vertical)

VII. Estimating amount of materials needed for wall and partition framing

A. Wall plates (2 x 4)

(NOTE: Plate material is usually ordered in sixteen-foot lengths.)

1. Determine the lineal footage of all outside walls, including openings

2. Determine the lineal footage of all inside walls, including partitions and openings

INFORMATION SHEET

3. Multiply the total, inside and outside lineal footage, by three

   (NOTE: There are three plates: sole plate, top plate, and double top plate.)

4. Divide the total lineal footage obtained in step number three by sixteen and round up to the next full number to get the number of sixteen-foot 2 x 4's needed for plates

B. Studs 16" on center

   (NOTE: Studs may be purchased precut or cut on the job from eight-foot or sixteen-foot 2 x 4's.)

   1. Determine the lineal footage of all outside and inside walls
   2. Allow one stud for each lineal foot of wall
   3. If sixteen-foot material is used, divide the total achieved in step number one by two for the number of sixteen-foot 2 x 4's needed for studs
   4. On buildings with gable roofs use one-half the plate length for determining the number of gable studs needed at each gable end
      a. Multiply one-half the plate length by three-quarters if the gable studs are 16" centers to determine the number needed
      b. Determine to the nearest whole foot the length of the longest gable stud from the double plate to the top of the roof

   (NOTE: One piece of stud material will make a long and a short gable stud; this is why only one-half of the plate length is used.)

C. Headers

   (NOTE: The use of 2 x 12 headers requires more material, but the time saved more than makes up for the difference.)

   1. From the door and window schedule determine size of all doors and windows

      (NOTE: List each door and window separately.)

   2. Add six inches to each door and window rise
   3. Double the length for each door and window
   4. Combine lengths obtained in step number three into convenient lengths for ordering and to minimize waste
   5. Order a bundle of laths or a sheet of 1/2" C-D plywood to cut up for spacers

INFORMATION SHEET

D. Diagonal bracing (if used)

(NOTE: Diagonal bracing is required at each end of all exterior walls. These braces run from top to bottom plate at an approximate angle of 45°. Walls 8'-0" high would require material twelve-feet long for each brace.)

1. Determine the number of outside and inside corners in the exterior walls
2. Multiply the number of corners by two to determine the number of twelve-foot 1 x 6's needed for bracing

E. Wall sheathing (8-foot wall)

1. Plywood
    a. Determine the lineal footage of all outside walls

       (NOTE: If there is a gable end, add one-half of the width of each gable to the total lineal footage of the outside walls.)

    b. Multiply the total lineal footage by eight to determine the total square feet of wall area
    c. Divide the square feet of wall area by thirty-two (the number of square feet in a sheet of plywood) and round up to the nearest whole number to determine the number of sheets of 4' x 8' plywood needed for sheathing
2. Gyplap
    a. Determine the lineal footage of all outside walls

       (NOTE: If there is a gable end, add one-half of the width of each gable to the total lineal footage of the outside walls.)

    b. Multiply the total lineal footage by eight to determine the total square feet of wall area
    c. If let-in bracing is used, divide the total square feet of wall area by sixteen (the square feet in a piece of gyplap) and round up to the next whole number to determine the number of pieces of gyplap needed for sheathing
    d. If plywood bracing is used, determine the number of inside and outside corners to be braced and multiply by four (the equivalent to the number of pieces of gyplap it replaces) and subtract this figure from the total number of pieces in Step c to get the number of pieces of gyplap needed for sheathing

INFORMATION SHEET

   e. Multiply the number of inside and outside corners by two to determine the number of pieces of plywood needed for bracing

3. Fiberboard

   a. Determine the lineal footage of all outside walls

      (NOTE: If there is a gable end, add one-half of the width of each gable to the total lineal footage of the outside walls.)

   b. Multiply the total lineal footage by eight to determine the total square feet of wall area

   c. If let-in bracing is used, divide the total square feet of wall area by thirty-two (the square feet in a piece of fiberboard) and round up to the next whole number to determine the number of pieces of fiberboard needed for sheathing

   d. If plywood bracing is used, determine the number of inside and outside corners to be braced and multiply by two (the number of pieces of fiberboard to be replaced at each corner) and subtract this figure from the total of pieces in Step c to get the number of pieces of fiberboard needed for sheathing

   e. Multiply the number of inside and outside corners by two to determine the number of pieces of plywood needed for bracing

4. Styrofoam--Will take the same amount of material as fiberboard

F. Ceiling joist on sixteen-inch centers

   1. Determine the size of joists needed from specifications

   2. Determine the length of the longest wall

   3. Number of ceiling joists needed equals wall length x 3/4 + 1

      (NOTE: A building greater than sixteen-feet wide will require a combination of lengths of joists.)

1410

INFORMATION SHEET

G. Nails

(NOTE: Use the table below for an estimate of the nails needed for a particular application.)

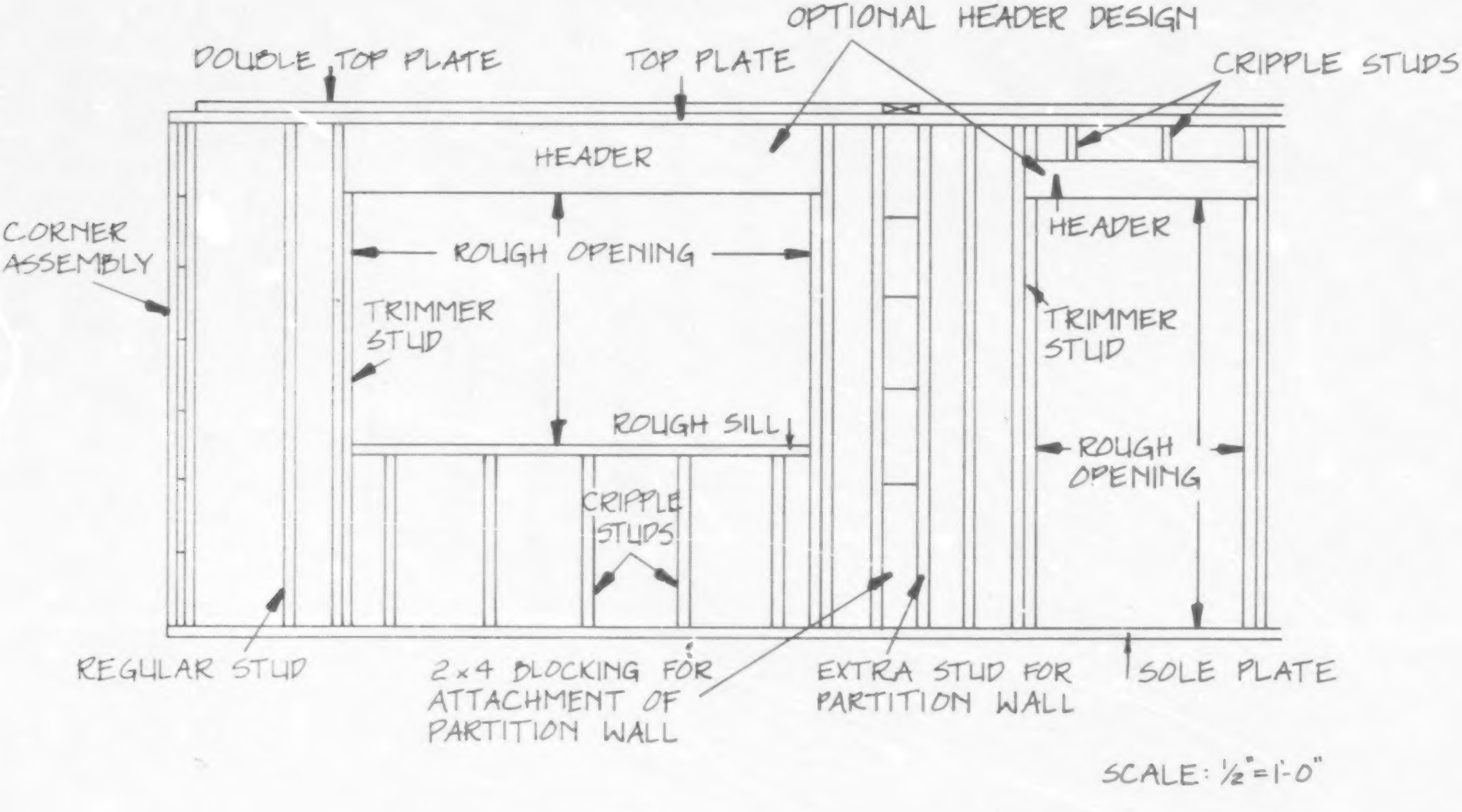
Application	Nail Size and Type	Amount
Wall Framing	8d box 16d box	2 lb. per 1000 bd. ft. 8 lb. per 1000 bd. ft.
Ceiling Framing	16d box	4 lb. per 1000 bd. ft.
Wall Sheathing		
Fiberboard 25/32"	8d box	30 lb. per 1000 sq. ft.
Fiberboard 1/2"	2" barbed roofing	15 lb. per 1000 sq. ft.
Gyplap 1/2"	1 1/2" barbed roofing	12 lb. per 1000 sq. ft.
Plywood 1/2"	6d box	10 lb. per 1000 sq. ft.
Styrofoam	1 1/2" roofing	12 lb. per 1000 sq. ft.

H. Exterior doors (excluding overhead)

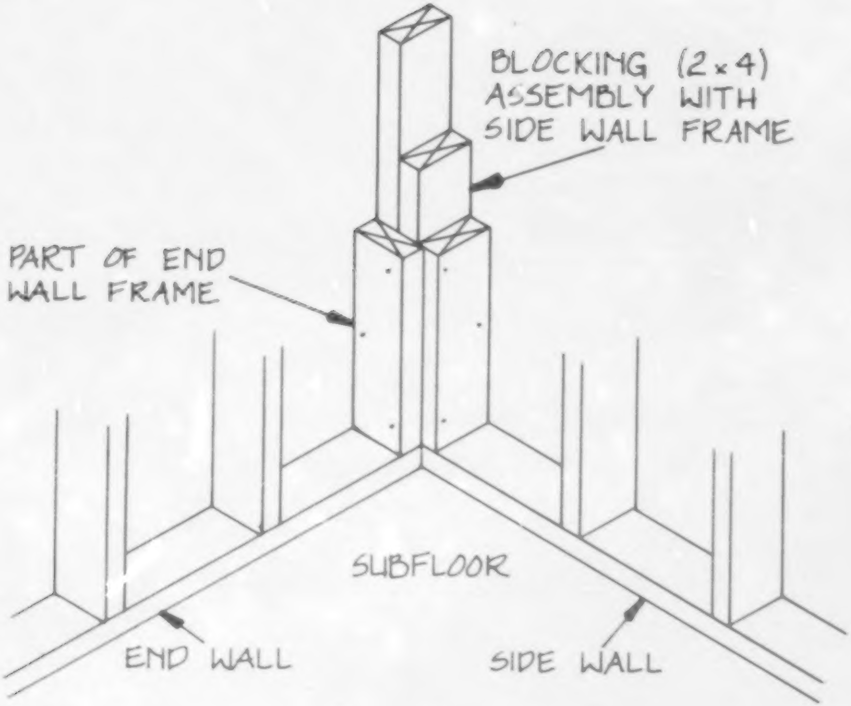
1. Determine the number of exterior jambs needed and the size
   a. With sills
   b. Without sills
2. Determine types and sizes of doors needed

   (NOTE: This information usually can be obtained from the specifications and door schedule.)

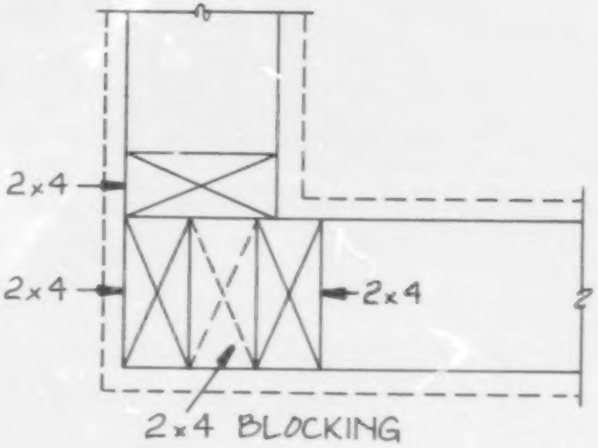
Wall and Partition Framing Members


OPTIONAL HEADER DESIGN
DOUBLE TOP PLATE
TOP PLATE
CRIPPLE STUDS
HEADER
HEADER
CORNER ASSEMBLY
ROUGH OPENING
TRIMMER STUD
TRIMMER STUD
ROUGH SILL
ROUGH OPENING
CRIPPLE STUDS
REGULAR STUD
2×4 BLOCKING FOR ATTACHMENT OF PARTITION WALL
EXTRA STUD FOR PARTITION WALL
SOLE PLATE
SCALE: ½"=1'-0"

Corners


BLOCKING (2×4) ASSEMBLY WITH SIDE WALL FRAME
PART OF END WALL FRAME
SUBFLOOR
END WALL
SIDE WALL

SCALE: 1"=1'-0"

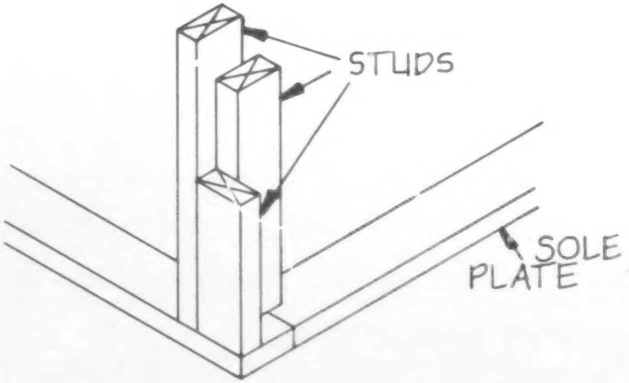

2×4
2×4
2×4
2×4 BLOCKING

(NOTE: BLOCKING DOES NOT HAVE TO BE CONTINUOUS.)

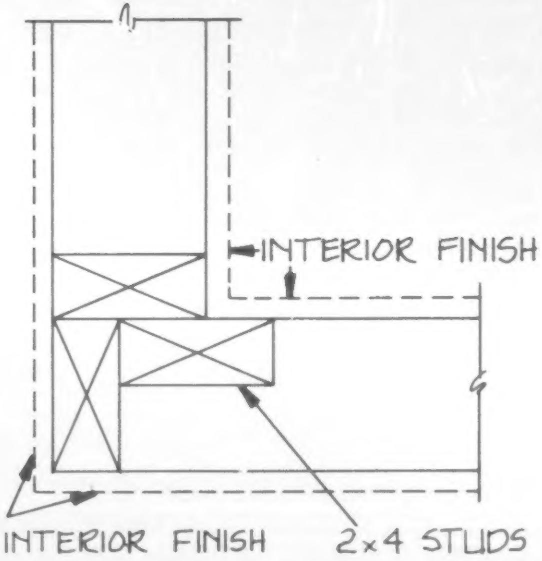
SCALE: 3"=1'-0"

Corners

(Continued)

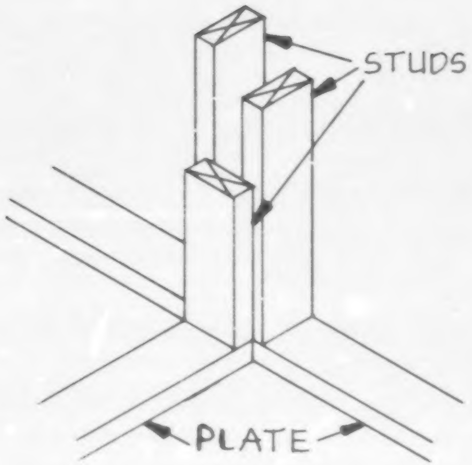

STUDS
SOLE PLATE

SCALE: 1"=1'-0"

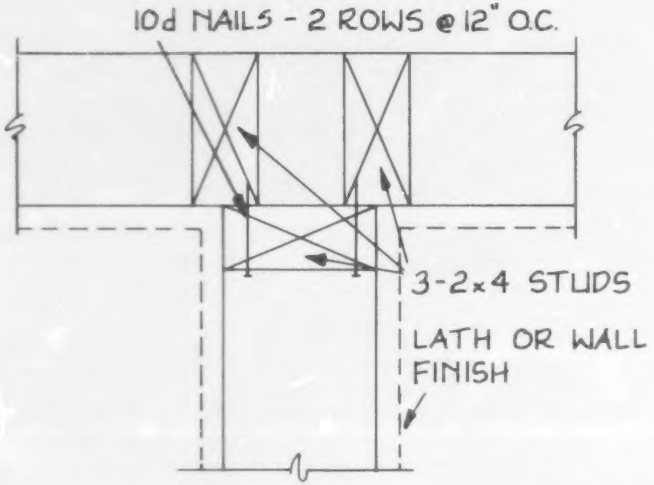

INTERIOR FINISH
INTERIOR FINISH
2×4 STUDS

SCALE: 3"=1'-0"

Partition T's

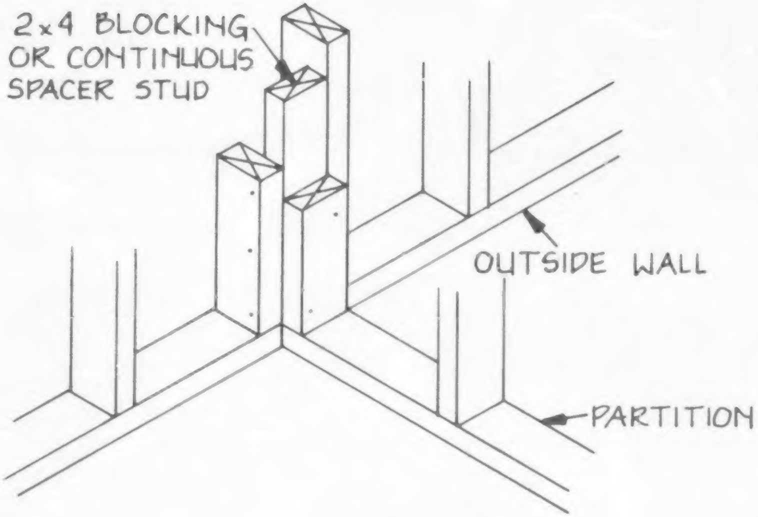

STUDS
PLATE

SCALE: 1"=1'-0"

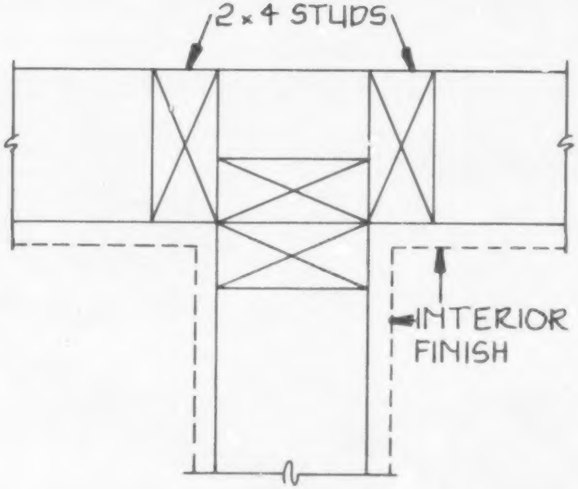

10d NAILS - 2 ROWS @ 12" O.C.
3-2×4 STUDS
LATH OR WALL FINISH

SCALE: 3"=1'-0"

Partition T's


2×4 BLOCKING
OR CONTINUOUS
SPACER STUD
OUTSIDE WALL
PARTITION

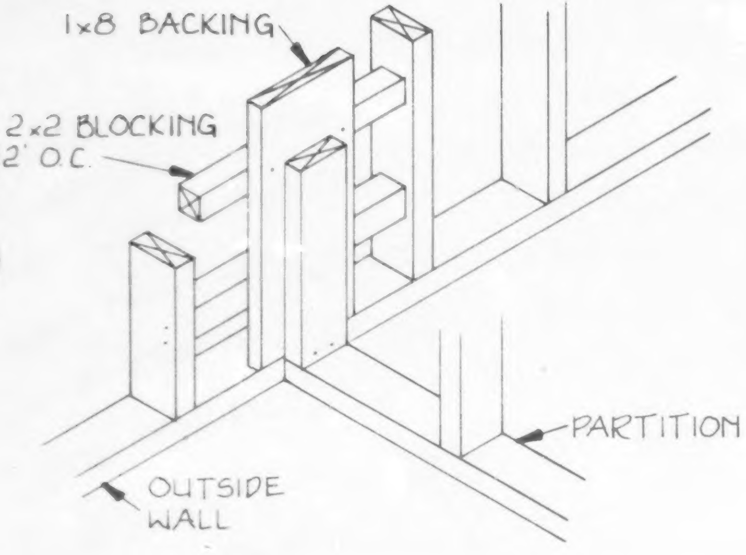
SCALE: 1"=1'-0"


2×4 STUDS
INTERIOR
FINISH

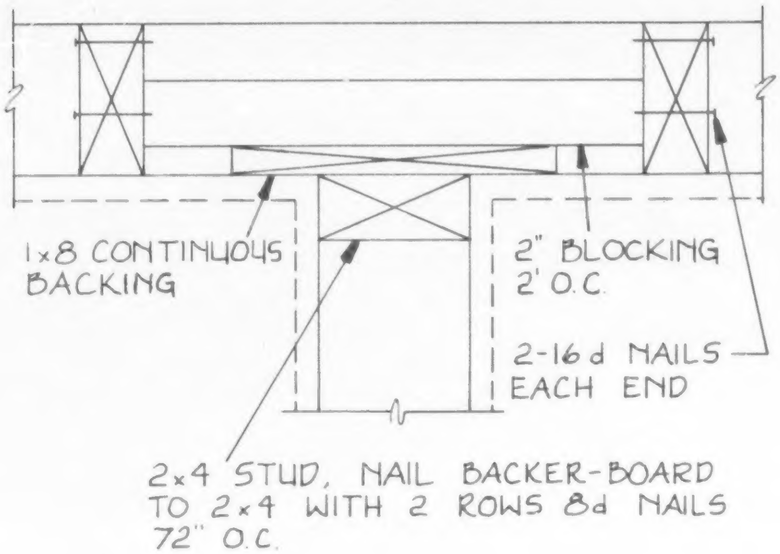
SCALE: 3"=1'-0"

Partition T's

(Continued)


1x8 BACKING
2x2 BLOCKING 2' O.C.
PARTITION
OUTSIDE WALL

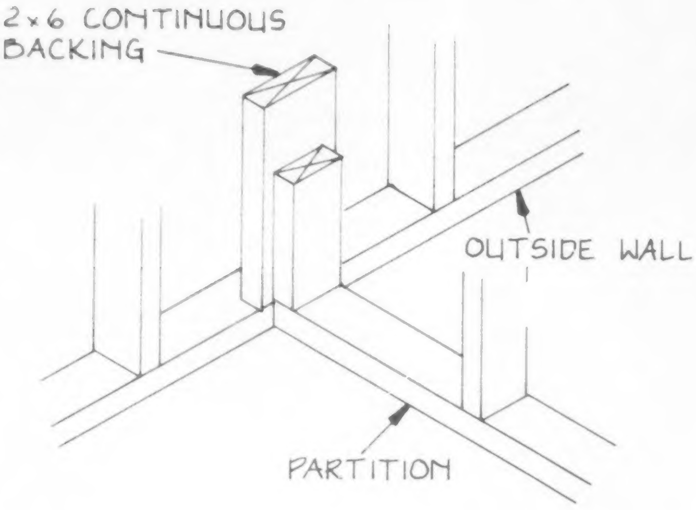
SCALE: 1"=1'-0"


1x8 CONTINUOUS BACKING
2" BLOCKING 2' O.C.
2-16d NAILS EACH END
2x4 STUD, NAIL BACKER-BOARD TO 2x4 WITH 2 ROWS 8d NAILS 72" O.C.

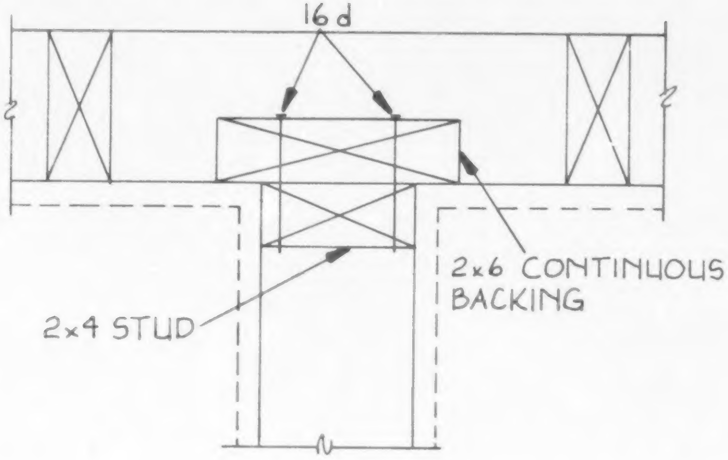
SCALE: 3"=1'-0"

Partition T's

(Continued)

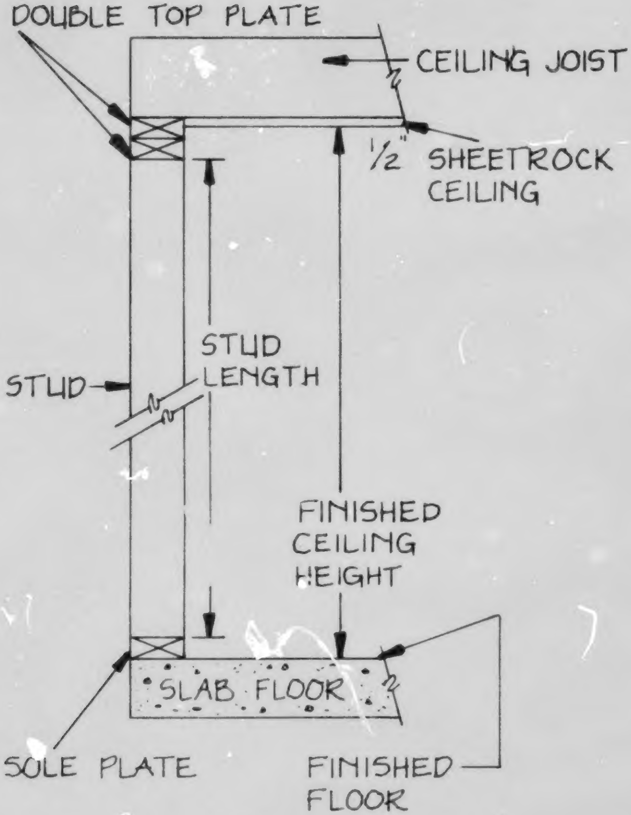

2×6 CONTINUOUS BACKING
OUTSIDE WALL
PARTITION

SCALE: 1"=1'-0"

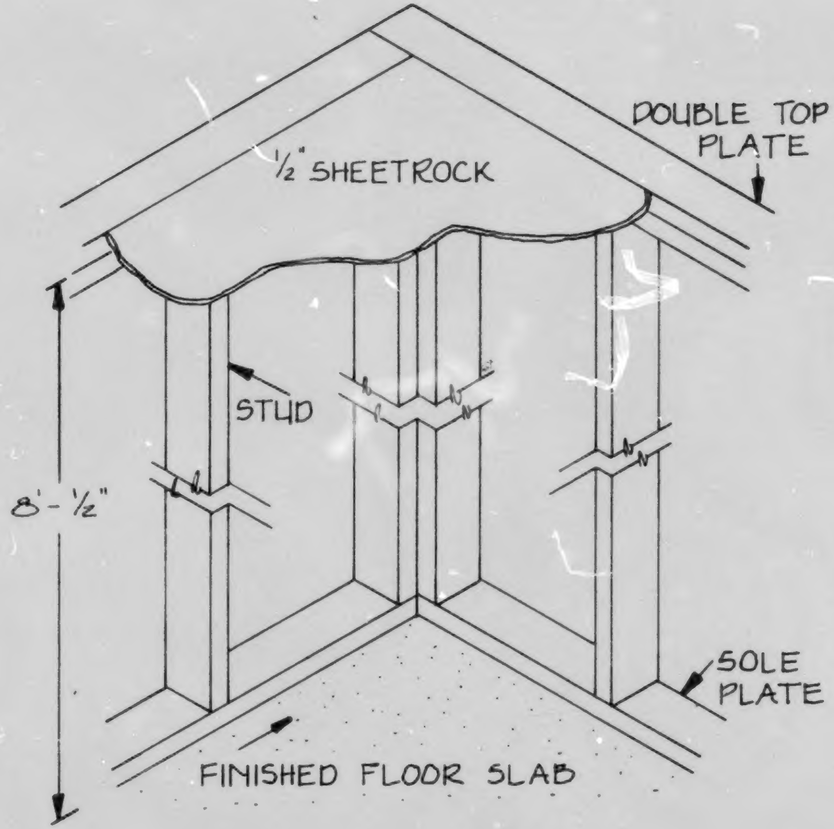

16d
2×6 CONTINUOUS BACKING
2×4 STUD

SCALE: 3"=1'-0"

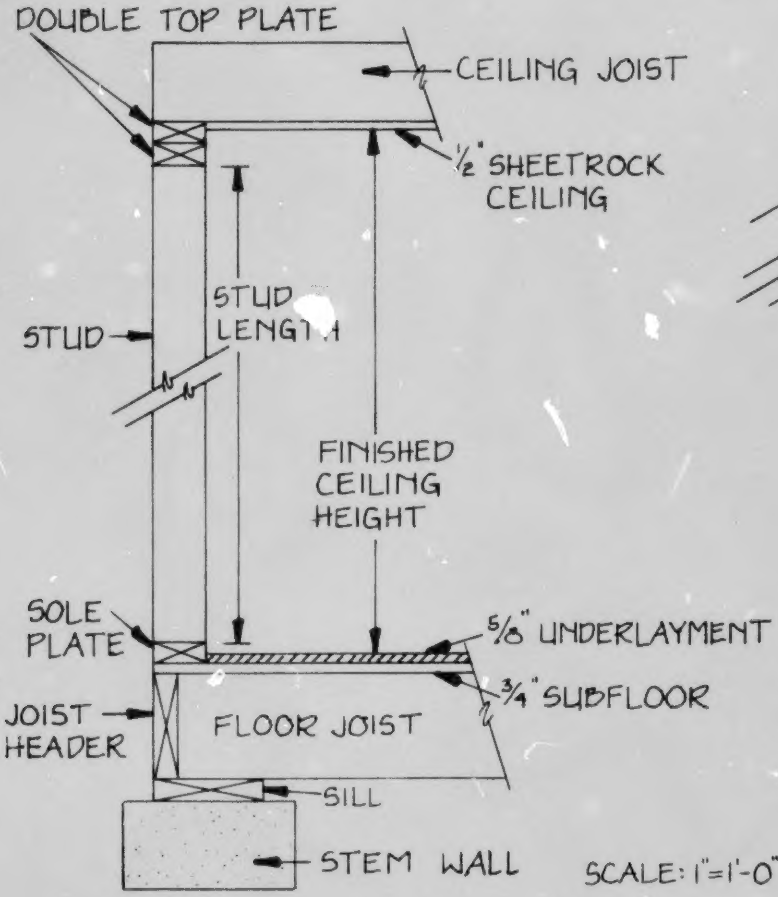
Stud Length For a Slab Floor

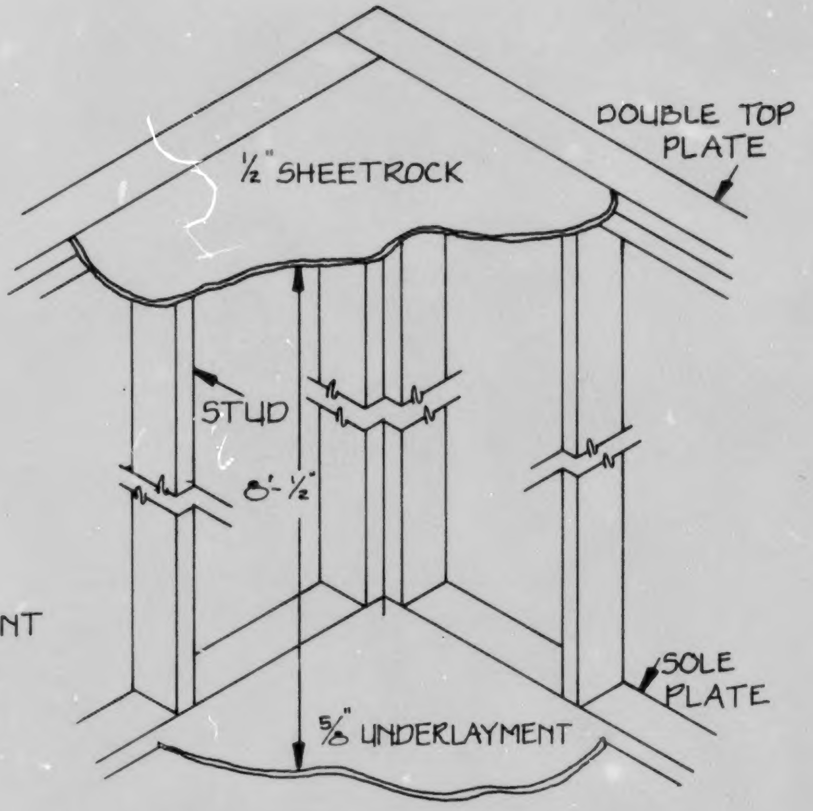

DOUBLE TOP PLATE
CEILING JOIST
1/2" SHEETROCK CEILING
STUD
STUD LENGTH
FINISHED CEILING HEIGHT
SLAB FLOOR
SOLE PLATE
FINISHED FLOOR

SCALE: 1"=1'-0"

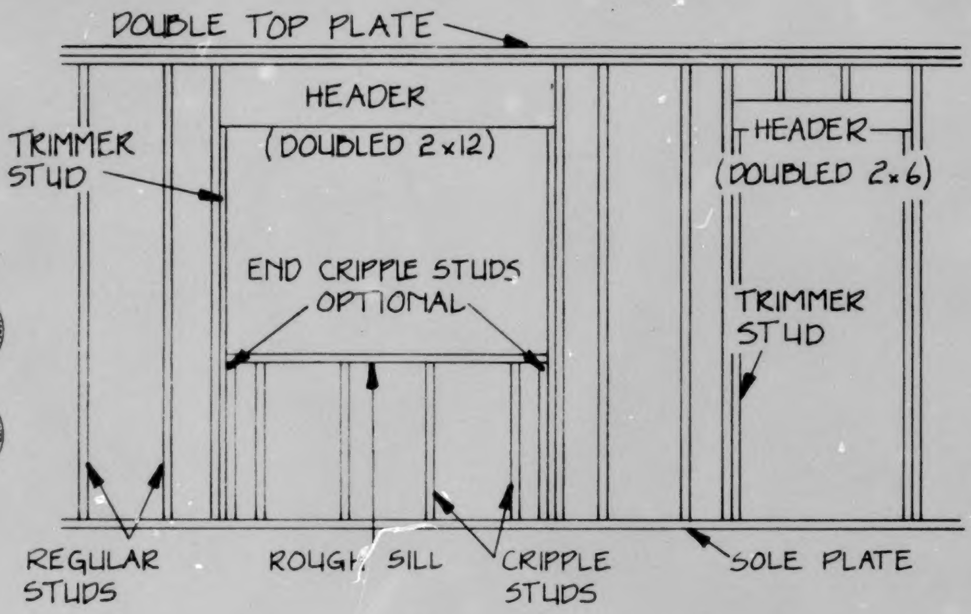

1/2" SHEETROCK
DOUBLE TOP PLATE
STUD
8'-1/2"
SOLE PLATE
FINISHED FLOOR SLAB

Stud Length For a Wood Floor


DOUBLE TOP PLATE
CEILING JOIST
1/2" SHEETROCK CEILING
STUD LENGTH
STUD
FINISHED CEILING HEIGHT
SOLE PLATE
5/8" UNDERLAYMENT
3/4" SUBFLOOR
JOIST HEADER
FLOOR JOIST
SILL
STEM WALL
SCALE: 1"=1'-0"

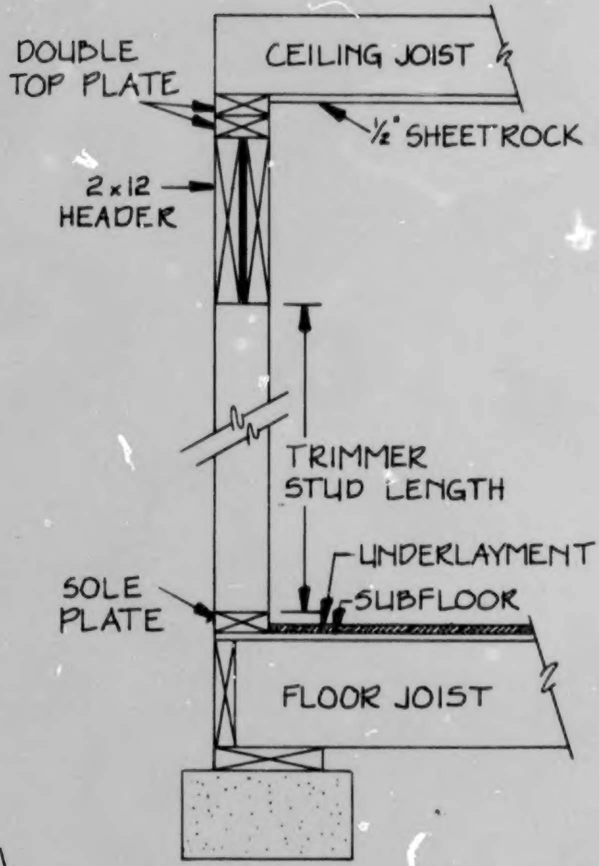

DOUBLE TOP PLATE
1/2" SHEETROCK
STUD
8'-1/2"
SOLE PLATE
5/8" UNDERLAYMENT

Trimmer Studs


DOUBLE TOP PLATE
HEADER
(DOUBLED 2×12)
TRIMMER STUD
END CRIPPLE STUDS OPTIONAL
HEADER
(DOUBLED 2×6)
TRIMMER STUD
REGULAR STUDS
ROUGH SILL
CRIPPLE STUDS
SOLE PLATE

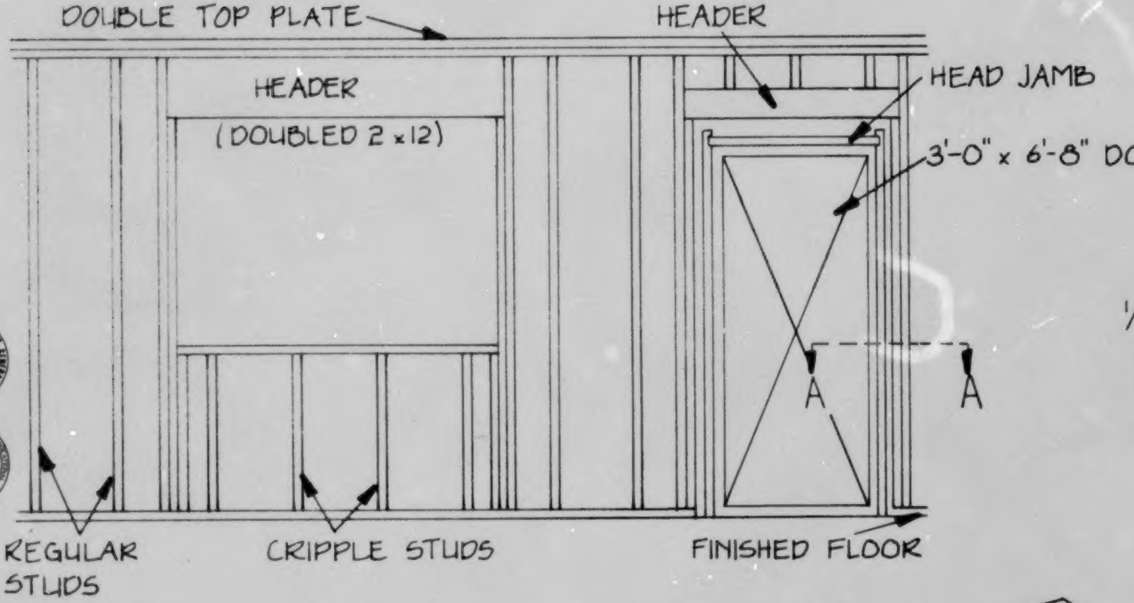
(NOTE: THE WINDOW HEADER IS LARGER THAN REQUIRED, BUT FILLS THE SPACE COMPLETELY, THUS SAVING LABOR IN CUTTING AND ASSEMBLING SHORT CRIPPLES.)

SCALE: 3/8" = 1'-0"

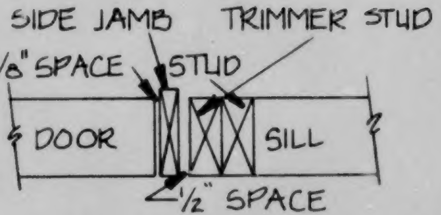

DOUBLE TOP PLATE
CEILING JOIST
1/2" SHEETROCK
2×12 HEADER
TRIMMER STUD LENGTH
UNDERLAYMENT
SUBFLOOR
SOLE PLATE
FLOOR JOIST

SCALE: 1" = 1'-0"

Door and Window Headers

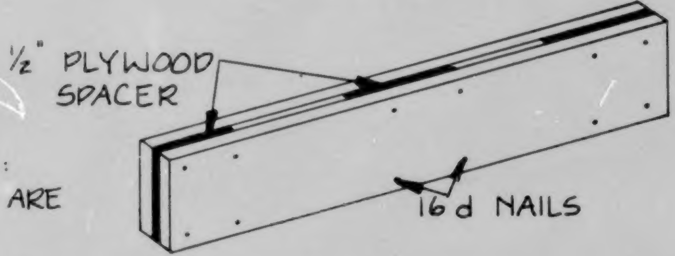

DOUBLE TOP PLATE
HEADER
HEADER
(DOUBLED 2 x 12)
HEAD JAMB
3'-0" x 6'-8" DOOR
A
A
REGULAR STUDS
CRIPPLE STUDS
FINISHED FLOOR

SCALE: 3/8" = 1'-0"


SIDE JAMB
TRIMMER STUD
1/8" SPACE
STUD
DOOR
SILL
1/2" SPACE

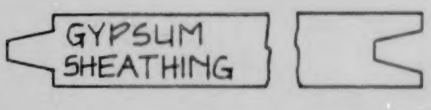
SECTION AA

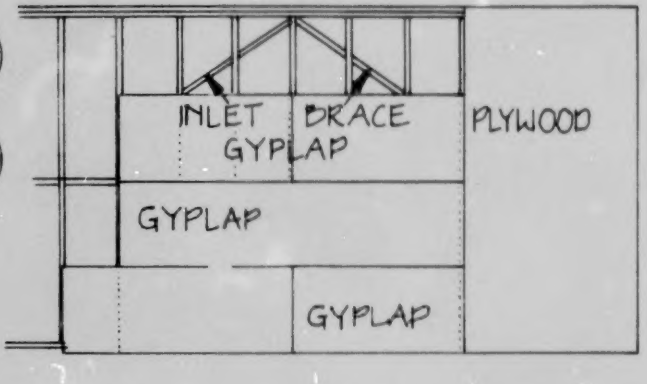
SCALE: 1½" = 1'-0"


½" PLYWOOD SPACER
16 d NAILS

HEADER CONSTRUCTION:
THE PLYWOOD SPACERS ARE
PLACED 16" TO 24" O.C.

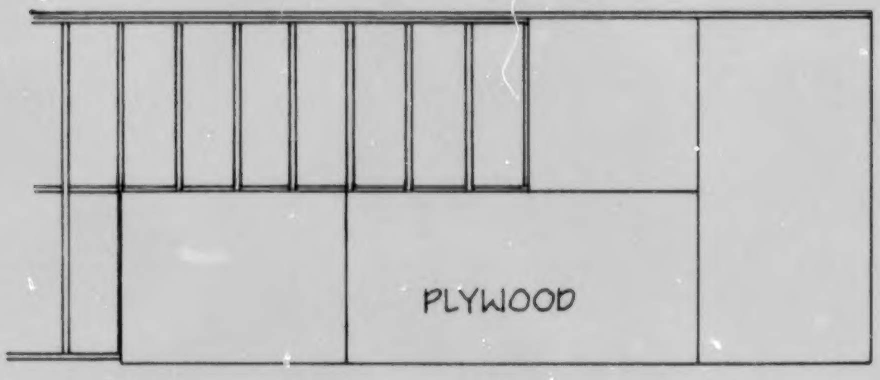
Types of Sheathing


GYPSUM
SHEATHING


INLET
BRACE
GYPLAP
PLYWOOD
GYPLAP
GYPLAP

GYPLAP SHEATHING

(NOTE: WITH GYPSUM SHEATHING, BRACE WALL EITHER WITH 1x4 INLET BRACING OR ½" x 4' x 8' VERTICAL PLYWOOD AT EACH CORNER)



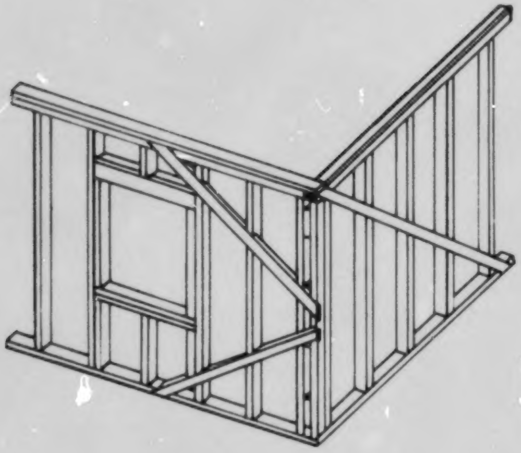
PLYWOOD SHEATHING

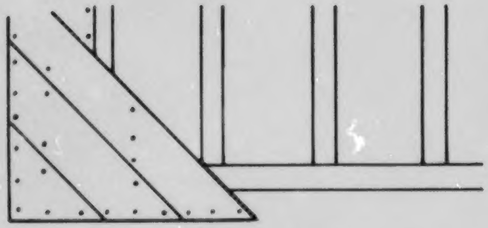
(NOTE: NO ADDITIONAL BRACING IS NEEDED WITH PLYWOOD SHEATHING.)

SCALE: ¼" = 1'-0"

Types of Sheathing

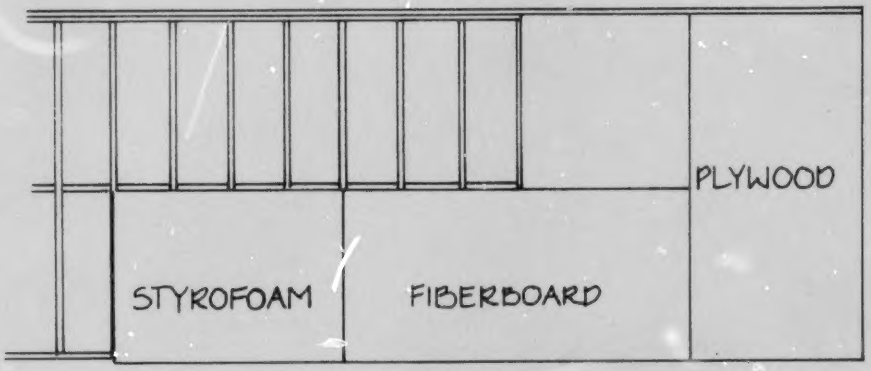
(Continued)





DIAGONAL SHEATHING

(NOTE: WITH DIAGONAL SHEATHING, NO ADDITIONAL BRACING IS REQUIRED.)


PLYWOOD
STYROFOAM
FIBERBOARD

FIBERBOARD SHEATHING

(NOTE: WITH FIBERBOARD OR STYROFOAM SHEATHING, USE INLET DIAGONAL BRACING OR PLYWOOD AT EACH CORNER.)

SCALE: 1/4" = 1'-0"

WALL AND PARTITION FRAMING
UNIT II

ASSIGNMENT SHEET #1--MATERIAL ESTIMATING

Using the information sheet, calculate the following framing material needed from the floor plan on the next page.

1. Wall plates (2 x 4's 16 feet long) ______________________________
2. Studs (2 x 4's 16 feet long) ______________________________
3. Headers (2 x 12) ______________________________

   ____

   ____
4. Diagonal bracing (1 x 6's 12 feet long) ______________________________
5. Wall sheathing (8-foot wall)
   a. Plywood ______________________________
   b. Gyplap (using plywood bracing) ______________________________

      ____
   c. Fiberboard (using plywood bracing) ______________________________
6. Nails
   a. Wall framing ______________________________

      ____
   b. Sheathing (1/2" fiberboard with plywood bracing) ______________________________

      ____

Door Sizes

Front 3068 x 1 3/4"--Ash solid core, exterior

Rear 2868 x 1 3/4"--Ash solid core, exterior,
24" x 24" lite

Toilets 2468 x 1 1/2"--Ash, hollow core

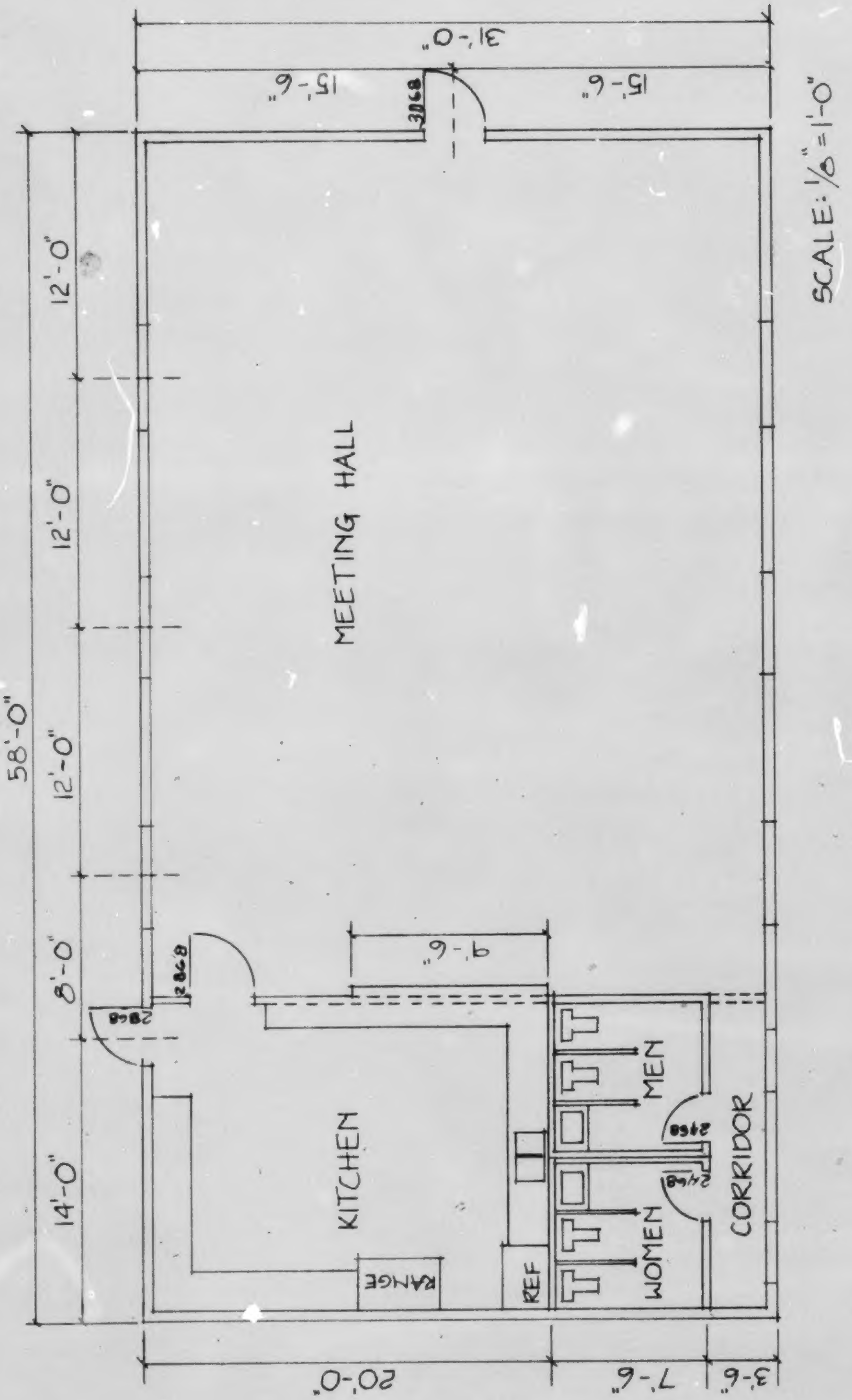
Kitchen, meeting hall--2868 x 1 1/2"
Ash, hollow core

Window Sizes

Meeting hall--5' x 4'

Corridor--3' x 4'

ASSIGNMENT SHEET #1


31'-0"
15'-6"
15'-6"
3068
12'-0"
12'-0"
12'-0"
58'-0"
8'-0"
14'-0"
MEETING HALL
9'-6"
2868
2868
KITCHEN
RANGE
REF
MEN
WOMEN
2468
2468
CORRIDOR
20'-0"
7'-6"
3'-6"
SCALE: 1/8" = 1'-0"

WALL AND PARTITION FRAMING
UNIT II

ANSWERS TO ASSIGNMENT SHEET #1

1. 47 - 2 x 4 x 16' for plates

2. 125 - 2 x 4 x 16' for studs

3. 8 - 2 x 12 x 12' for headers

   1 - 2 x 12 x 14' for headers

   1 - 2 x 12 x 16' for headers

4. 8 - 1 x 6 x 12' diagonal bracing

5. a. 45 - 1/2" x 4' x 8' plywood

   b. 74 pieces 1/2" x 4' x 8' gyplap

      8 pieces 1/2" x 4' x 8' plywood

   c. 37 pieces 1/2" x 4' x 8' fiberboard

      8 pieces 1/2" x 4' x 8' plywood

6. a. 3 pounds 8d box nails

      12 pounds 16d box nails

   b. 18 pounds 2" barbed roofing nails

      3 pounds 6d box nails

WALL AND PARTITION FRAMING
UNIT II

JOB SHEET #1--LAY OUT WALL AND PARTITION LOCATIONS ON FLOOR

I. Tools and materials

   A. Chalk line and reel

   B. Tape, 100 ft

   C. Tape, 12 or 16 ft

   D. Claw hammer

   E. Nails, 16d

   F. Floor plan

   G. Framing square

II. Procedure

   A. Lay out outside walls first

      1. Measure in the width of a 2 x 4 from the outside edge of the box still on a wood floor and from the outside of the foundation on a slab floor; start a nail at each mark

         (NOTE: This is for a wood floor only.)

      2. Fasten chalk line to nail at one corner, stretch the line to another nail at an opposite corner, and snap line

         (NOTE: Make sure the line is sufficiently well chalked and have a helper hold the line in the middle to keep it from touching the floor before you are ready to snap it. If laying off a slab floor, you will need an additional helper to hold other end of the line.)

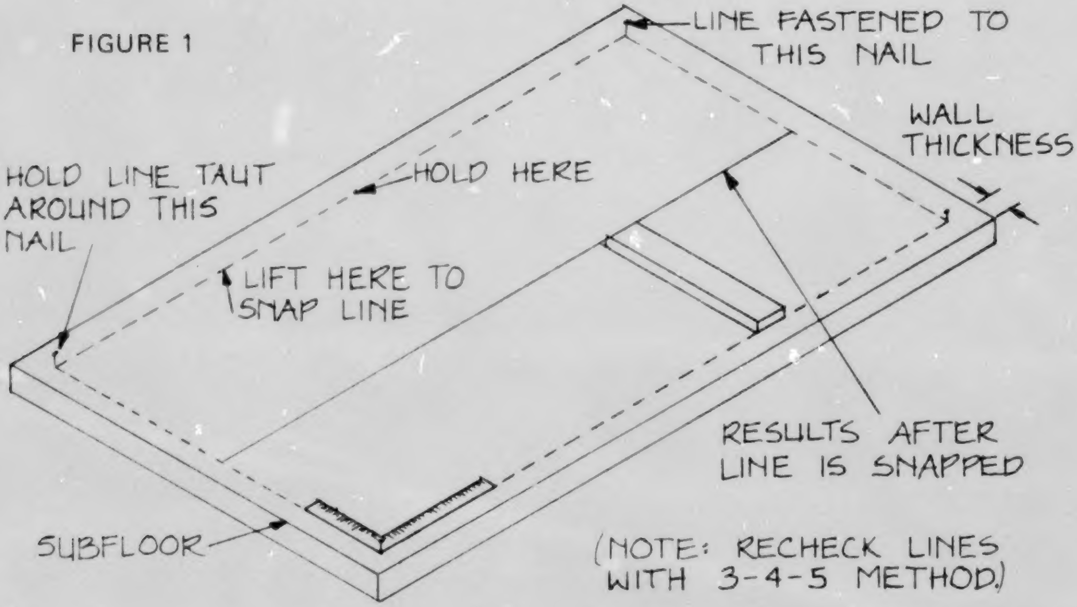
      3. Pull the line tight from one end, have the center person place thumb on the line approximately in the center between the two nails; holding line firmly to the floor, the center person reaches out with other hand and carefully lifts the line and lets it snap to the floor, repeating the procedure for other half

         (NOTE: This operation should result in a perfectly straight line which represents the inside face of the outside wall sole plate.)

JOB SHEET #1

4. Use framing square to square off of first line to turn 90° corner; repeat procedure for all outside walls (Figure 1)

FIGURE 1


LINE FASTENED TO THIS NAIL
WALL THICKNESS
HOLD LINE TAUT AROUND THIS NAIL
HOLD HERE
LIFT HERE TO SNAP LINE
RESULTS AFTER LINE IS SNAPPED
SUBFLOOR
(NOTE: RECHECK LINES WITH 3-4-5 METHOD)

B. Lay out inside walls--Chalk both sides of partition walls (Figures 2 and 3)

(NOTE: Lay out all the walls running the length of the building first, then the ones running the width of the building. Some floor plans are dimensioned by rooms and some are dimensioned center to center on partitions.)

FIGURE 2

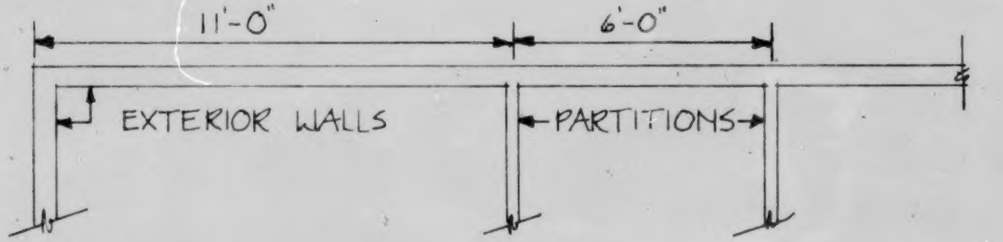
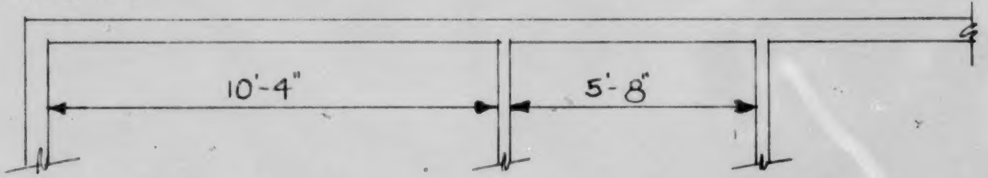

11'-0"
6'-0"
EXTERIOR WALLS
PARTITIONS

FIGURE 3



WALL AND PARTITION FRAMING
UNIT II

JOB SHEET #2--CUT STUDS, TRIMMERS, CRIPPLES, AND HEADERS TO LENGTH

I. Tools and materials

- A. Tools
    1. Radial arm saw (with extensions)
    2. Tape, 12 or 16 foot
    3. Claw hammer
    4. C clamp
- B. Materials
    1. 2 x 4's 16 feet long
    2. Nails, 16d box
    3. 2 x 12's
    4. 1/2" plywood

II. Procedure

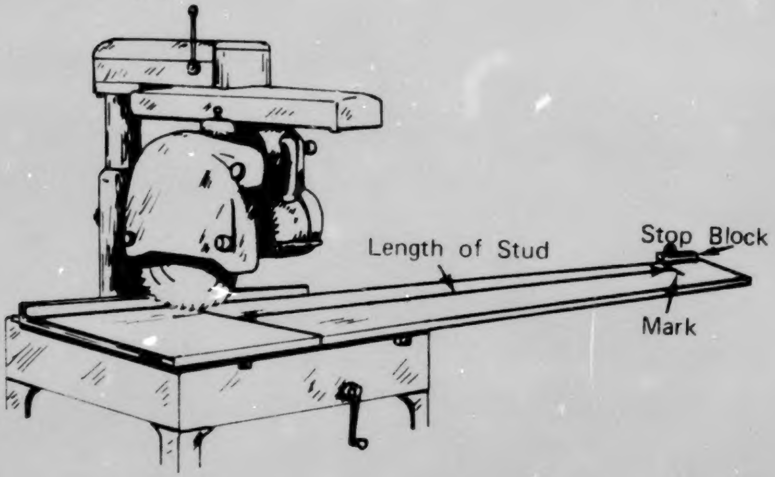
- A. Studs
    1. Determine the number needed
    2. Determine the length of full studs

JOB SHEET #2

3. Set up radial arm saw to cut studs

   a. Measure from the right side of the blade the length of the stud and make a mark on the extension table (Figure 1)

FIGURE 1



   b. Cut a scrap piece of 2 x 4 about sixteen inches long; nail or clamp the 2 x 4 piece to the table at mark that was made in Step a (Figure 1)

   (NOTE: Undercut the block slightly.)

4. Cut studs from sixteen-foot 2 x 4's

   (NOTE: Studs precut to size can be purchased.)

   a. Square right end of 2 x 4

   b. Slide 2 x 4 along table until it touches the stop block

   c. Cut first stud

   (CAUTION: Do not bump block too hard so that it is moved out of position.)

   d. Check stud for correct length

JOB SHEET #2

e. Repeat Step c

f. Repeat previous steps to cut remainder of studs

(NOTE: Check every fifteen to twenty studs to be sure they are uniform in length.)

(CAUTION: Follow all safety rules concerning the radial saw.)

B. Trimmer studs

1. Determine number needed
2. Determine length of trimmer studs
3. Follow previous procedures to set up saw to cut trimmer studs
4. Use 2 x 4's as short as possible to cut trimmer studs

C. Cripple studs

1. Determine number needed
2. Determine lengths needed
3. Follow previous procedure to set up saw for longest cripple stud
4. Use 2 x 4's as short as possible to cut cripple studs

(NOTE: Repeat entire procedure for each length of cripple stud.)

D. Headers

1. Determine number needed for each size opening

   (NOTE: Remember that each header requires two pieces.)

2. Determine the lengths needed
3. Follow previous procedure to set up saw to cut headers

   (NOTE: Cut the longest headers first.)

4. Cut headers from 2 x 12 stock

   (NOTE: Repeat entire procedure for each length of header.)

JOB SHEET #2

5. Cut spacers for headers from 1/2" plywood

    a. Three spacers are needed for short headers and more for longer headers

    b. Spacers should be cut slightly less than the width of the header and they should be about 1 1/2" wide

(NOTE: Plan all your cuts so that waste is held to a minimum.)

WALL AND PARTITION FRAMING
UNIT II

JOB SHEET #3--BUILD CORNERS, T's, AND HEADERS

I. Tools and materials

   A. Tools

      1. Claw hammer, 16 ounce or larger

      2. Electric handsaw

      3. Tape

   B. Materials

      1. 2 x 4 studs

      2. 2 x 4 stock for blocking

      3. 16d box nails

      4. 2 x 12 header material cut to length

      5. 1/2" plywood for header spacers

II. Procedure

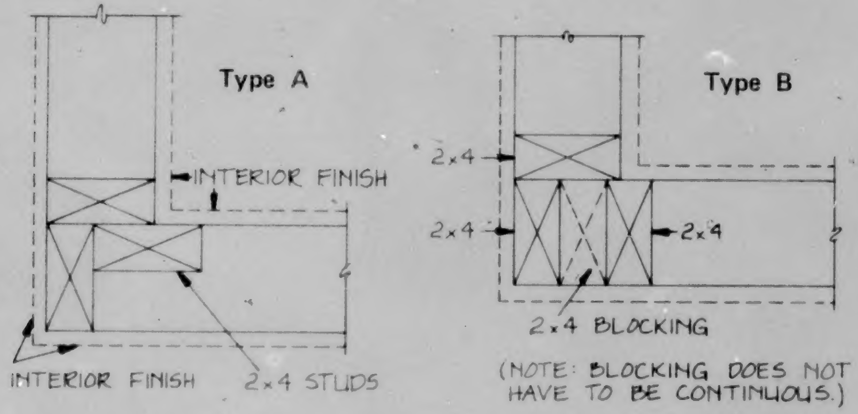
   A. Corners (Transparencies 2 and 3)

      1. Determine the number of corners needed

      2. Select three of the straighest studs for each corner

      3. Determine type of corner to use (Figure 1)

FIGURE 1


Type A
INTERIOR FINISH
INTERIOR FINISH
2x4 STUDS
Type B
2x4
2x4
2x4
2x4 BLOCKING
(NOTE: BLOCKING DOES NOT HAVE TO BE CONTINUOUS.)

(NOTE: Type B corners are preferred by most builders.)

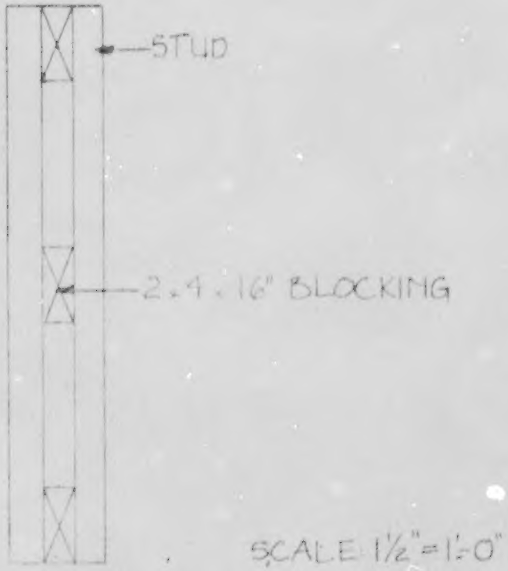
JOB SHEET #3

4. Construct Type B corners

   a. Cut three 2 x 4's 16" long for blocking for each corner

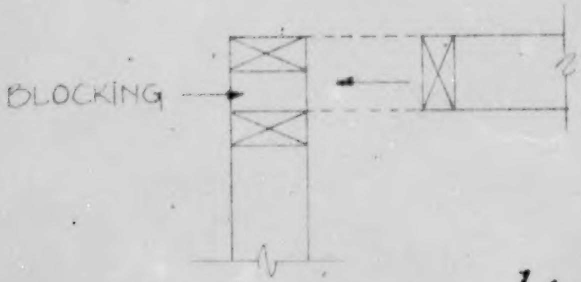
   b. Nail two studs together with blocking between (Figure 2)

FIGURE 2


STUD
2 x 4 x 16" BLOCKING
SCALE 1½"=1'-0"

   c. Attach third stud to end of end wall and nail to corner as walls are erected (Figure 3)

FIGURE 3



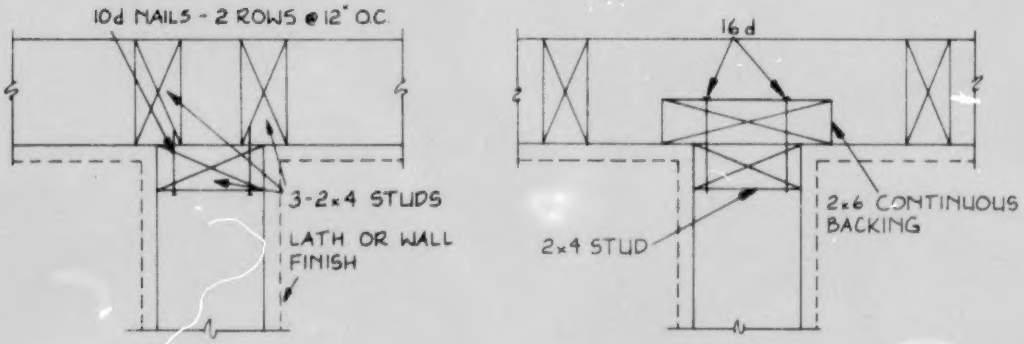
1415

JOB SHEET #3

B. T's (Transparencies 4, 5, and 6)

1. Determine the number of T's needed
2. Determine which of the three types of T's to use (Figure 4)

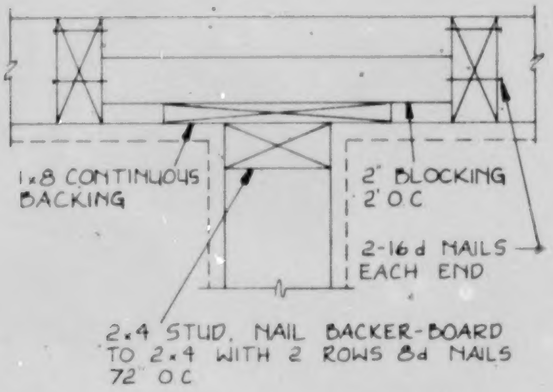
FIGURE 4



TYPE A

TYPE B

10d NAILS - 2 ROWS @ 12" O.C.
3-2x4 STUDS
LATH OR WALL FINISH
16 d
2x6 CONTINUOUS BACKING
2x4 STUD



TYPE C

1x8 CONTINUOUS BACKING
2" BLOCKING 2' O.C
2-16 d NAILS EACH END
2x4 STUD, NAIL BACKER-BOARD TO 2x4 WITH 2 ROWS 8d NAILS 72" O.C

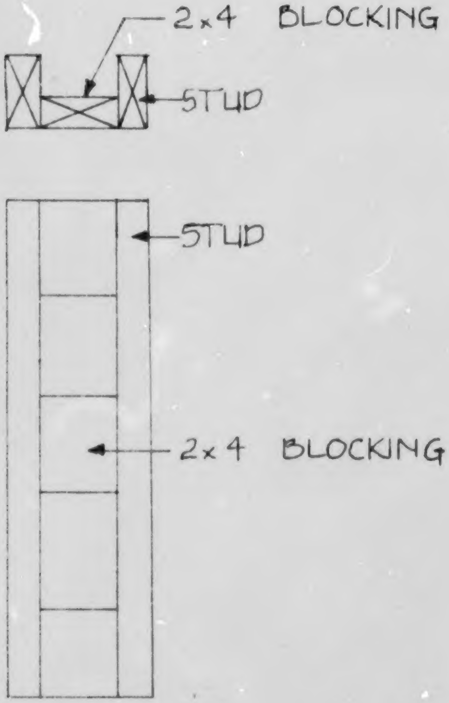
(NOTE: Type A is preferred by most builders.)

3. Construct Type A corners
   - a. Select three of the straightest studs for each corner
   - b. Cut three 2 x 4's 16" long for blocking for each corner

JOB SHEET #3

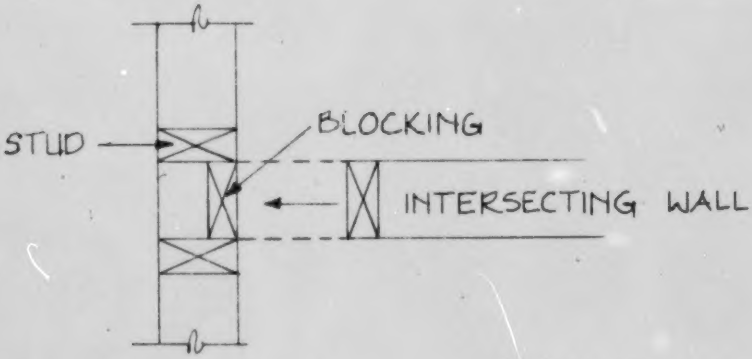
c. Nail two studs together with blocking between (Figure 5)

FIGURE 5


2×4 BLOCKING
STUD
STUD
2×4 BLOCKING

d. Attach third stud to the end of the intersecting wall and nail to 2 x 4 x 16" blocking as walls are erected (Figure 6)

FIGURE 6


STUD
BLOCKING
INTERSECTING WALL

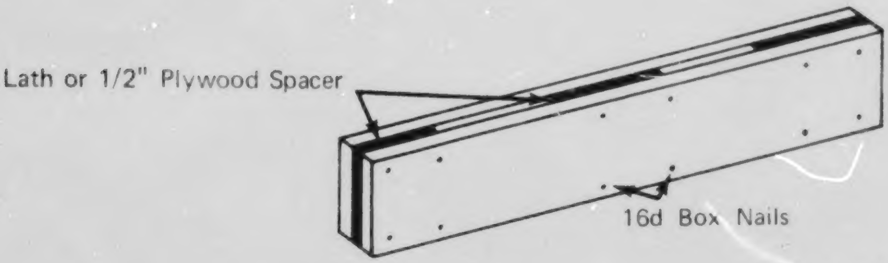
SCALE: 1½"=1'-0"

JOB SHEET #3

C. Headers

1. Determine the number of headers needed of each size
2. Nail together two 2 x 12's with spacers between, using 16d box nails (Figure 7)

FIGURE 7


Lath or 1/2" Plywood Spacer
16d Box Nails

Header Construction--Spacers Are Placed 16" to 24" O. C.

WALL AND PARTITION FRAMING
UNIT II

JOB SHEET #4--CONSTRUCT WALL SECTIONS FOR A SINGLE-STORY STRUCTURE

I. Tools and materials

A. Tools

1. Tape measure, 12 or 16 feet
2. Claw hammer, 16 oz or larger
3. Framing square
4. Electric handsaw
5. Level, 4'
6. Tape, 100 ft, marked 16" on center

B. Materials

1. Nails
   a. 16d
   b. 8d
2. Regular studs
3. Corners
4. T's for partitions
5. Headers
6. 2 x 4's for plates, 16' long
7. Cripple studs
8. Trimmer studs
9. Brace material, 1 x 4's 12' long or 4' x 8' plywood

JOB SHEET #4

II. Procedure

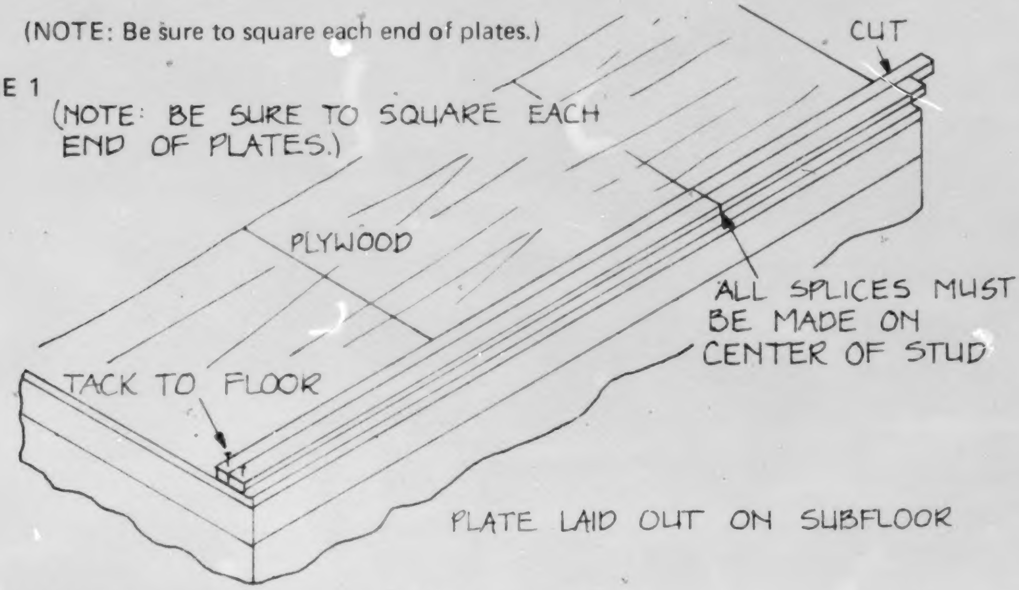
A. Select 2 x 4's from sixteen-foot stock for plates

(NOTE: Crooked 2 x 4's may be used for sole plates since they can easily be straightened. Straight stock should be saved for top plates.)

B. Cut sole plate and top plate to length and tack to floor side by side with ends flush (Figure 1)

(NOTE: Be sure to square each end of plates.)

FIGURE 1

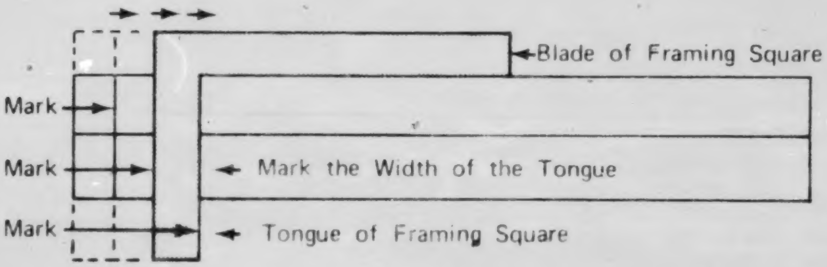

(NOTE: BE SURE TO SQUARE EACH END OF PLATES.)
CUT
PLYWOOD
ALL SPLICES MUST BE MADE ON CENTER OF STUD
TACK TO FLOOR
PLATE LAID OUT ON SUBFLOOR

C. Lay off stud locations on plates doing side walls first

(NOTE: Lay off all walls from left to right.)

1. Mark plates for corner post
2. Use framing square with blade parallel to the edge of the plates and mark off (Figure 2)

FIGURE 2

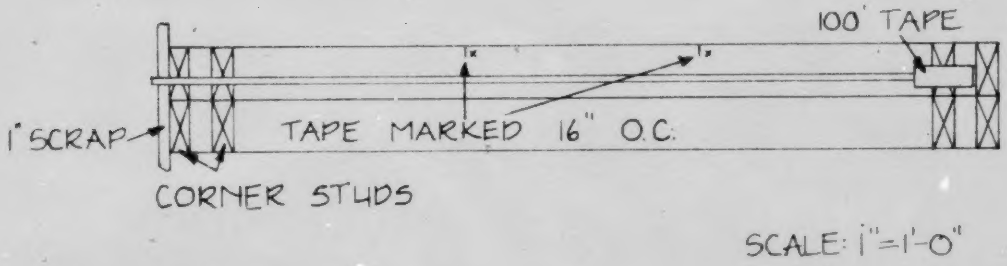

Blade of Framing Square
Mark
Mark
Mark
Mark the Width of the Tongue
Tongue of Framing Square

JOB SHEET #4

3. Use 100-foot tape and lay off full stud locations

   a. Place scrap of one-inch material at left end of plate; hook end of tape over one-inch piece and make a mark on the plates at sixteen-inch intervals; place a small *X* at the right of each mark (Figure 3)

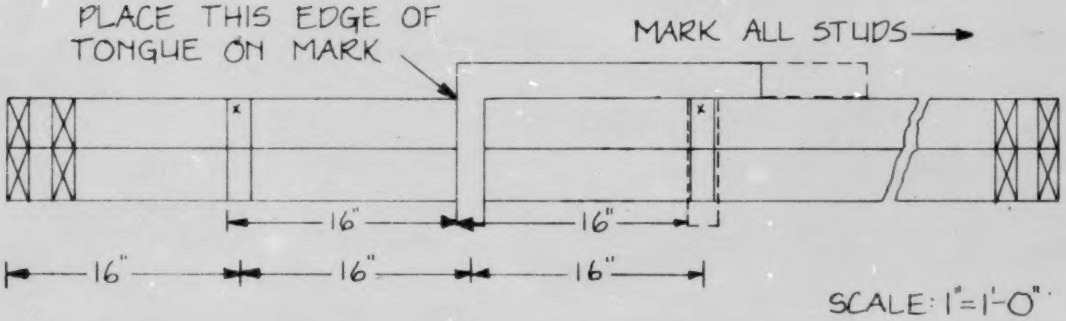
FIGURE 3


100' TAPE
1" SCRAP
TAPE MARKED 16" O.C.
CORNER STUDS
SCALE: 1"=1'-0"

   b. Use framing square and mark stud locations across both plates (Figure 4)

   c. Follow same procedure as in Figure 1 (Figure 4)

FIGURE 4


PLACE THIS EDGE OF TONGUE ON MARK
MARK ALL STUDS
16"
16"
16"
16"
16"
SCALE: 1"=1'-0"

4. Locate center of openings and lay off trimmer stud locations

   a. Divide the header size by two and mark one-half of header length on each side of center

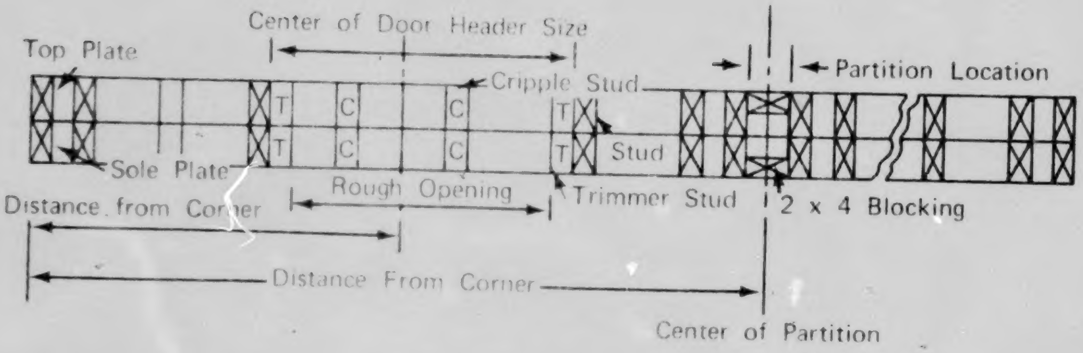
      (NOTE: This locates outside of each trimmer stud.)

   b. Mark trimmer stud locations with a *T* and cripple studs with a *C*

JOB SHEET #4

5. Locate and mark partitions on the plates with the style **T** you plan to use (Figure 5)

FIGURE 5


Center of Door Header Size
Top Plate
Cripple Stud
Partition Location
T
C
Stud
Sole Plate
Rough Opening
Trimmer Stud
2 x 4 Blocking
Distance from Corner
Distance From Corner
Center of Partition

6. Lay off other side wall using same procedure

7. Lay off end walls using same procedure

(NOTE: Remember that end walls will fit between side walls; therefore, the plates will be two 2 x 4 widths shorter than outside wall dimensions.)

8. Remove nails from plates

D. Assemble wall sections

1. Turn plates on edge with marks facing each other

2. Place sole plate at edge of floor

3. Move top plate toward center of structure approximately nine feet

4. Lay studs at each *X* mark

(NOTE: If studs are crooked, turn so that crown is up.)

5. Place appropriate size headers in place

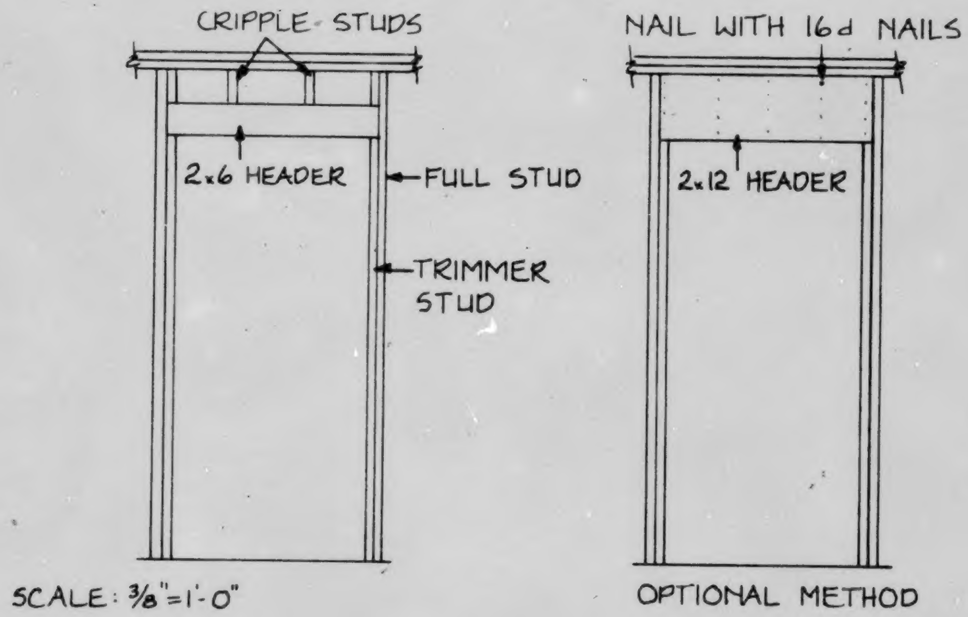
(NOTE: Use minimum header material to avoid settling by shrinkage.)

JOB SHEET #4

6. Place trimmer studs at each spot marked with a *T*

   (NOTE: Trimmer studs, full studs, and headers may be preassembled. See Figure 6.)

FIGURE 6


CRIPPLE STUDS
2x6 HEADER
FULL STUD
TRIMMER STUD
SCALE: 3/8"=1'-0"
NAIL WITH 16d NAILS
2x12 HEADER
OPTIONAL METHOD

7. Place rough sills and cripple studs in place

E. Nail framework together

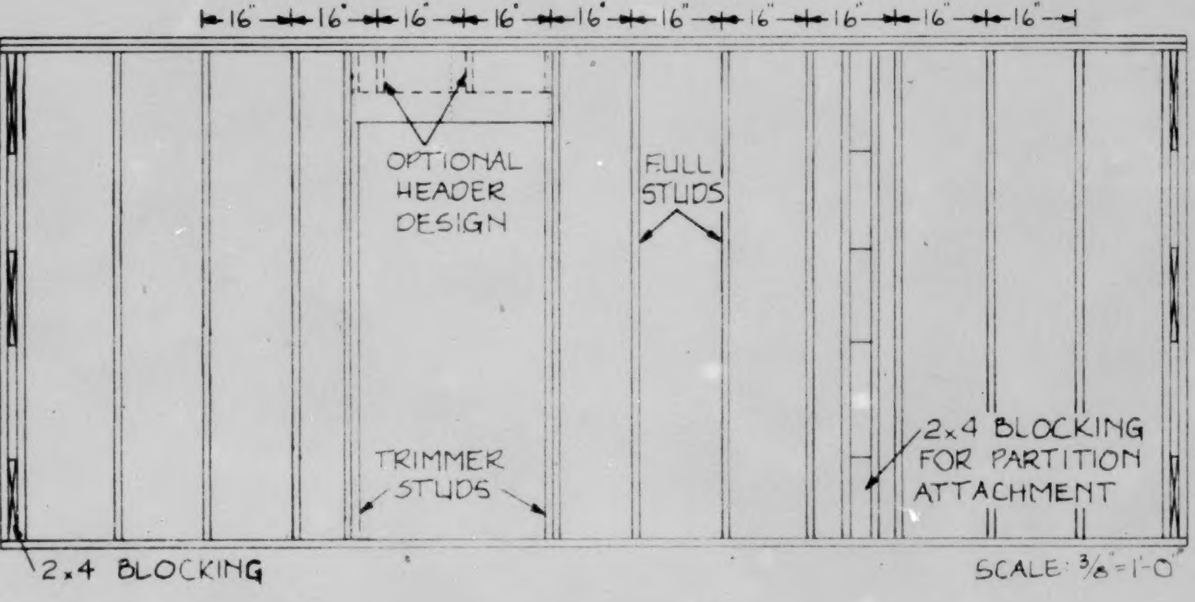
   1. Drive two 16d nails through the plate into end of each stud

   2. Nail cripple studs in place and install rough sills where needed

JOB SHEET #4

3. Finish nailing framework together (Figure 7)

FIGURE 7


16"
16"
16"
16"
16"
16"
16"
16"
16"
16"
OPTIONAL HEADER DESIGN
FULL STUDS
2x4 BLOCKING FOR PARTITION ATTACHMENT
TRIMMER STUDS
2x4 BLOCKING
SCALE: 3/8"=1'-0"

F. Raise wall section and nail in place

(NOTE: At this time, the walls should be up, squared, plumbed, and braced, and sheathing should be applied.)

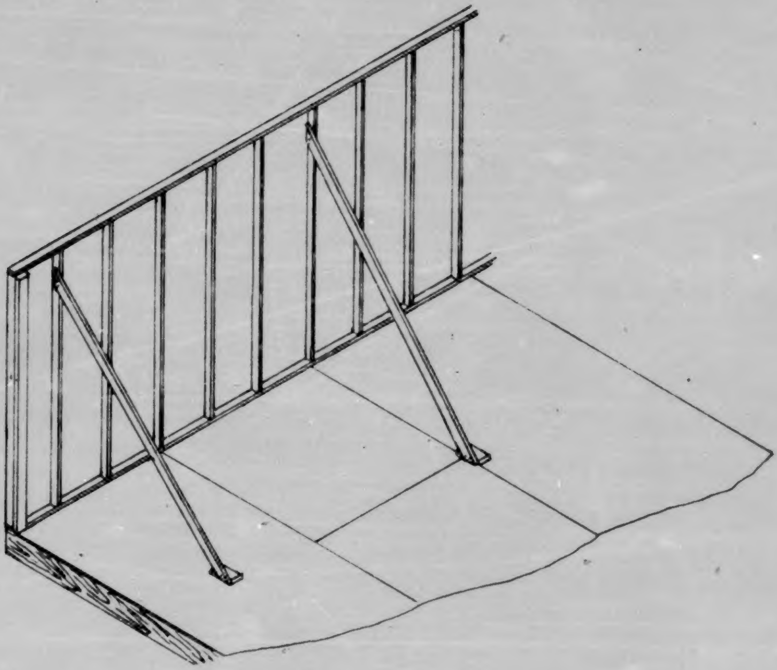
1. On wood floors use two 16d nails in every other floor joist

2. For concrete slabs use concrete nails, powder actuated tool and pins, or preset anchor bolts

JOB SHEET #4

3. Attach temporary bracing (Figure 8)

FIGURE 8



G. Use same procedure to construct remainder of wall sections; raise and nail in place

(NOTE: Construct all main bearing wal[illegible]irst; then proceed with roof to get in dry area in case of bad weather; [illegible]lete other partitions.)

H. Nail all corners together using 16d nails

I. Plumb corners and install bracing

JOB SHEET #4

J. Install double plate (Figures 9 and 10)

(NOTE: Using 16d nails, nail corners and intersections as shown in Figures 9 and 10. Nail remainder of double plates every sixteen inches, alternating nails from side to side.)

FIGURE 9

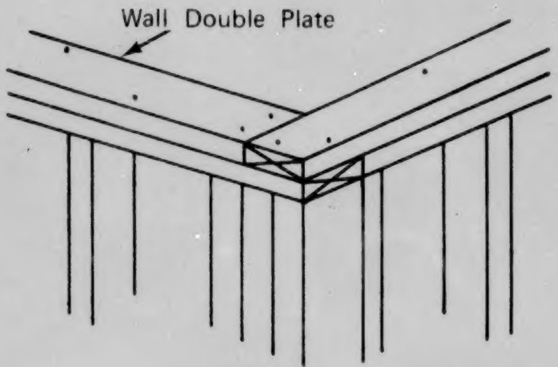
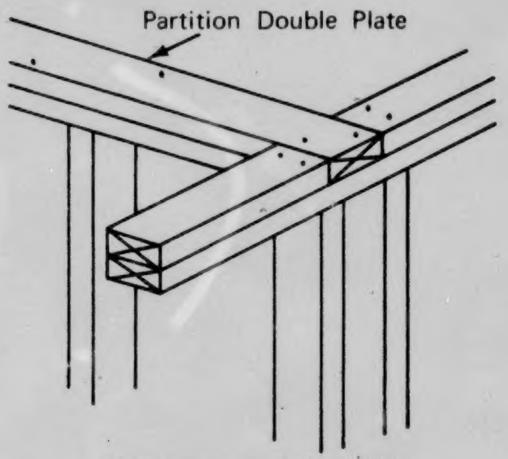

Wall Double Plate
Wall Corner

FIGURE 10


Partition Double Plate
Partition Intersecting Wall

Double Plate Installation at Corners and Intersections

JOB SHEET #4

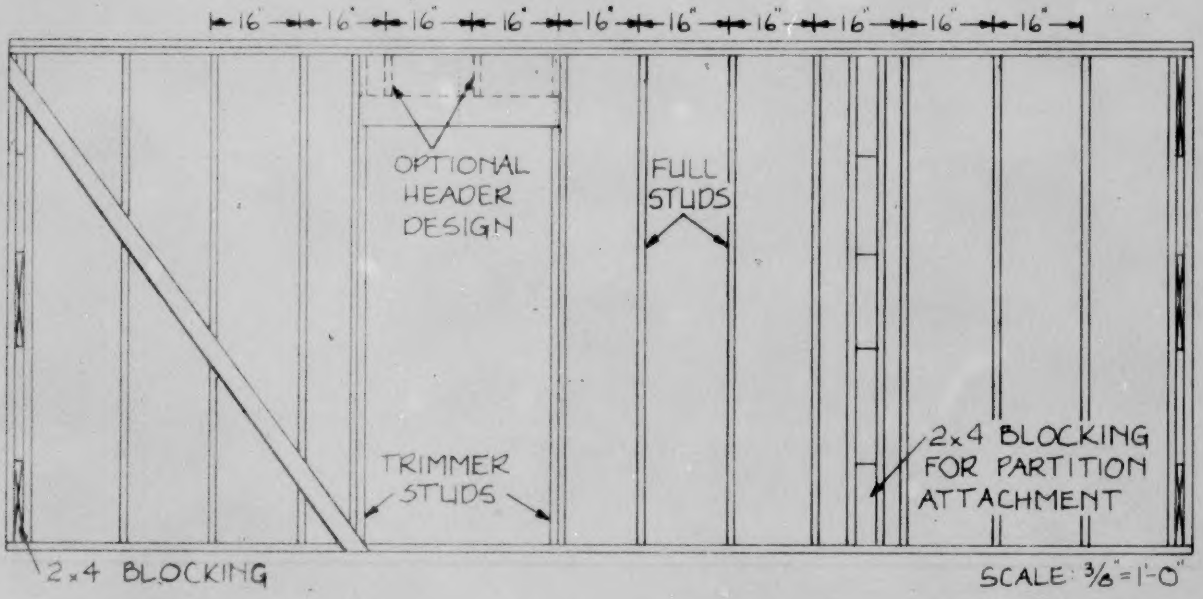
K. Replumb corners

L. Install permanent bracing; brace corners with inlet bracing when using fiberboard, styrofoam, or gyplap sheathing

(NOTE: When using diagonal lumber or plywood corners, no additional bracing is needed.)

1. Lay 1 x 4 x 12' bracing against studs with left end near top of corner stud and right end against sole plate
2. Mark each side of brace on each stud
3. Saw out section on each stud to receive brace
4. Nail top left-hand corner of brace securely to corner
5. Recheck for plumb
6. Nail brace to all other studs and to sole plate (Figure 11)

FIGURE 11


16"
16"
16"
16"
16"
16"
16"
16"
16"
16"
OPTIONAL HEADER DESIGN
FULL STUDS
TRIMMER STUDS
2x4 BLOCKING FOR PARTITION ATTACHMENT
2x4 BLOCKING
SCALE: 3/8"=1'-0"

WALL AND PARTITION FRAMING
UNIT II

JOB SHEET #5--INSTALL SHEATHING

I. Tools and materials

- A. Tools
    - 1. Electric handsaw
    - 2. Tape, 12 or 16 ft
    - 3. Claw hammer, 16 ounce
    - 4. Framing square
    - 5. Chalk line and reel
    - 6. Straightedge
- B. Materials
    - 1. Sheathing material as specified
        - a. Fiberboard
        - b. Gyplap
        - c. Plywood
        - d. Styrofoam
        - e. Styrofoam adhesive
    - 2. Nails
        - a. For fiberboard
            - 1) For 25/32" fiberboard use 8d box
            - 2) For 1/2" fiberboard use 2" barbed roofing
        - b. Gyplap--1 1/2" barbed roofing
        - c. Plywood--6d box
        - d. Styrofoam--1 1/2" roofing

JOB SHEET #5

II. Procedure

A. Fiberboard (4' x 8' sheets)

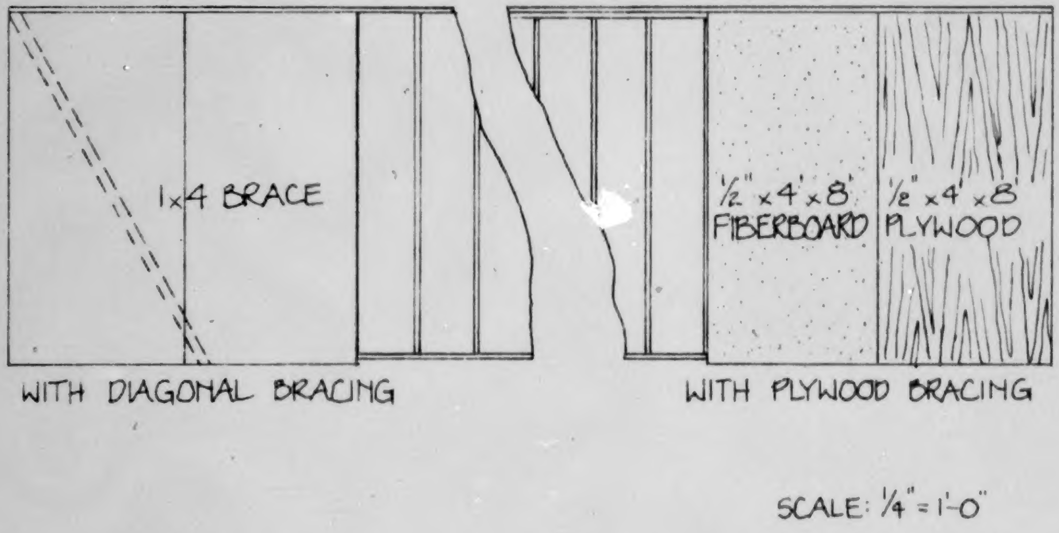
(NOTE: Either diagonal bracing or plywood corners must be installed before starting to apply fiberboard.)

1. Start at lower left corner of wall

2. Apply fiberboard sheathing (Figure 1)

(NOTE: Styrofoam sheathing will be applied with the same procedure.)

FIGURE 1


1x4 BRACE
½" x 4' x 8' FIBERBOARD
½" x 4' x 8' PLYWOOD
WITH DIAGONAL BRACING
WITH PLYWOOD BRACING
SCALE: ¼" = 1'-0"

(NOTE: Tack panels in place and, after wall is covered, chalk lines vertically on each stud and complete the nailing. An optional method is to use a staple gun.)

B. Gyplap

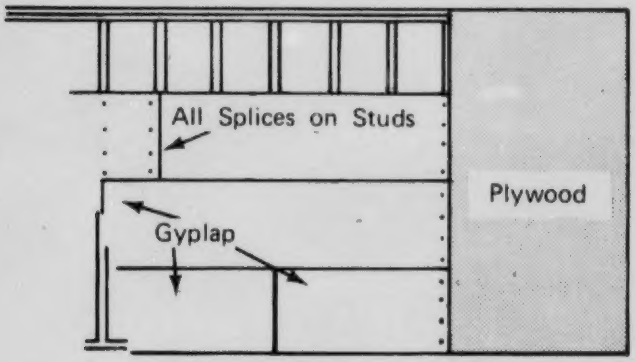
(NOTE: Either diagonal bracing or plywood corners must be installed before starting to apply gyplap.)

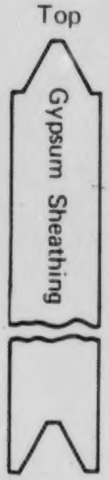
1. Start at lower left corner of the wall

JOB SHEET #5

2. Apply gyplap (Figure 2)

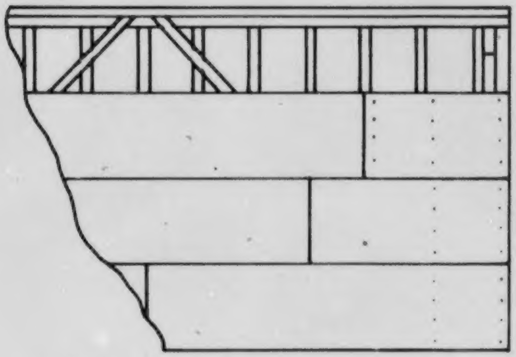
(NOTE: Tack panels in place and cover entire wall. Then chalk vertical lines on all studs and complete nailing.)


All Splices on Studs
Gyplap
Plywood


Top
Gypsum Sheathing

With Plywood Bracing

FIGURE 2



With Diagonal Bracing

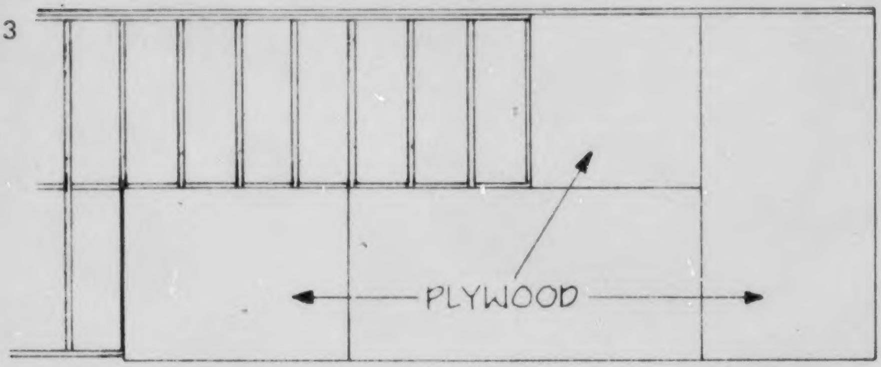
JOB SHEET #5

C. Plywood (Figure 3)

1. Start at the lower left corner of the wall
2. Apply plywood sheathing

   (NOTE: No additional bracing is required when plywood is used. See Figure 3. Tack panels in place and cover entire wall, then chalk vertical lines over all studs and complete nailing.)

FIGURE 3



PLYWOOD SHEATHING

(NOTE NO ADDITIONAL BRACING IS NEEDED WITH PLYWOOD SHEATHING.)

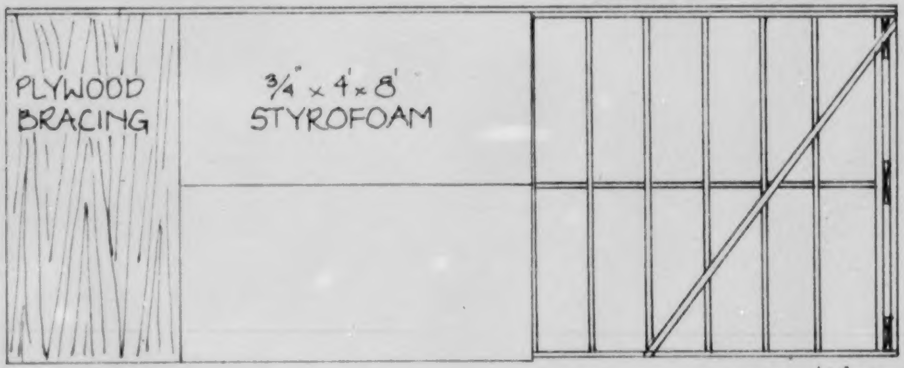
SCALE: 1/4"=1'-0"

D. Styrofoam

1. Start at lower left corner of the wall
2. Apply styrofoam sheathing (Figure 4)

   (NOTE: Diagonal or 4' x 8' plywood bracing can be used and blocking as required.)

FIGURE 4



SCALE: 1/4"=1'-0"

(NOTE: Styrofoam sheathing can also be applied by using mastic on studs and then applying styrofoam to this.)

WALL AND PARTITION FRAMING
UNIT II

JOB SHEET #6--LAY OUT AND INSTALL CEILING JOISTS

I. Tools and materials

A. Tools

1. Tape measure, 100 foot, with markings at 16-inch centers
2. Tape measure, 12 or 16 foot
3. Claw hammer, 16 ounce or larger
4. Electric handsaw
5. Hatchet
6. Framing square

B. Materials

1. Joists, lengths and sizes as specified
2. Nails, 16d box

II. Procedure

A. Lay out joist locations on double plate

1. For a gable roof

a. Determine the direction joists will run (usually the short way of the structure)

b. Locate the outside of the first joist flush with the inside corner of the double plate

(NOTE: See Figure 1 for hip roof.)

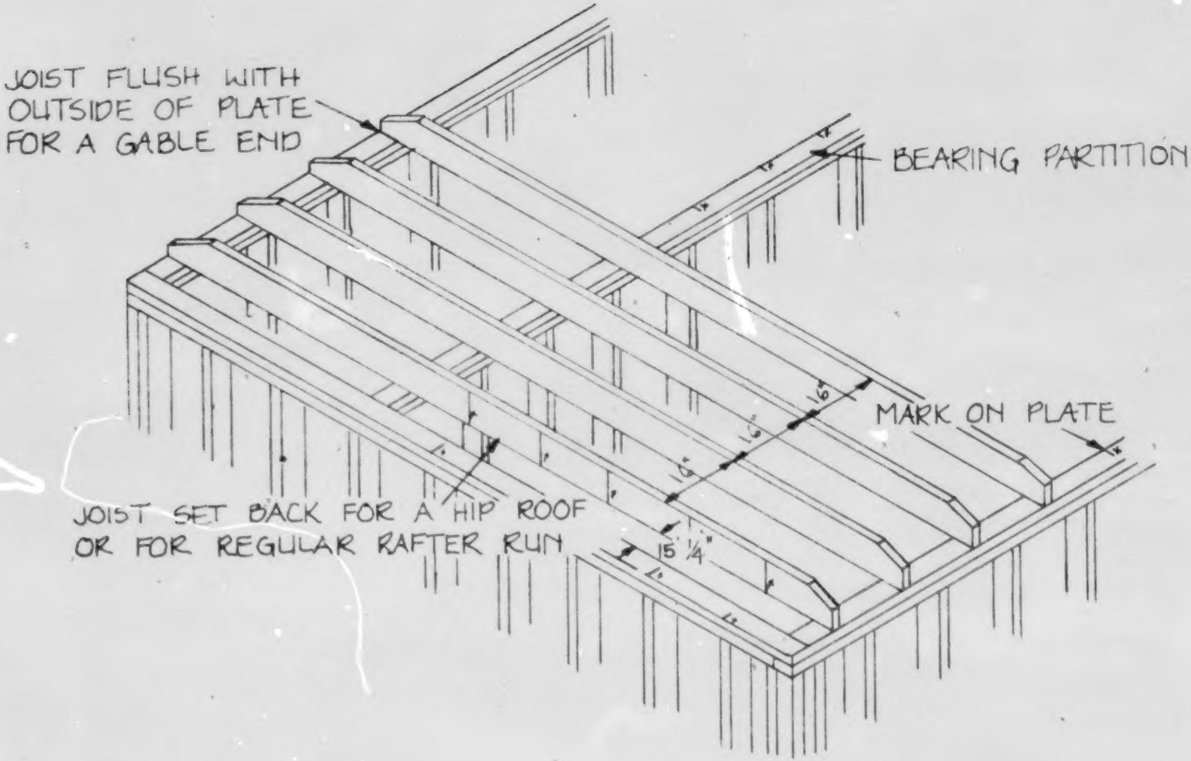
c. Hold the 0 end of the 100-foot tape 3/4" over the inside of the end double plate and proceed to mark sixteen-inch intervals on the plate, moving from left to right; place an *X* to the right of each mark

(NOTE: The *X* designates the side of the mark on which joist is placed.)

JOB SHEET #6

d. Repeat Steps b and c on the opposite wall, reversing the procedure of measurement going from right to left (Figure 1)

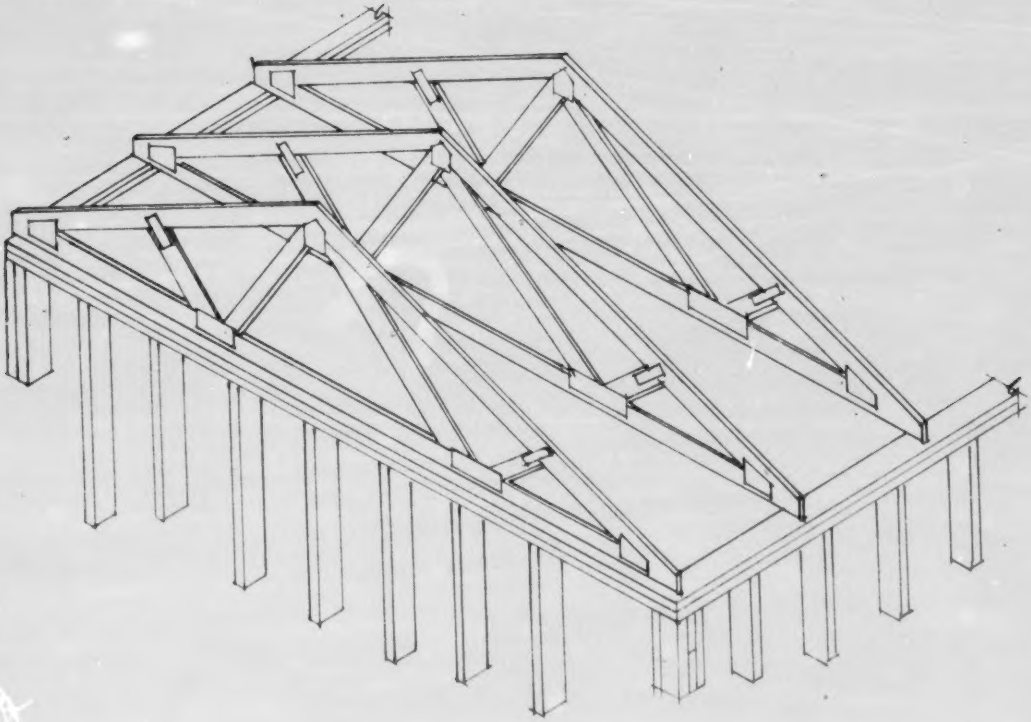
FIGURE 1


JOIST FLUSH WITH OUTSIDE OF PLATE FOR A GABLE END
BEARING PARTITION
MARK ON PLATE
16"
16"
16"
15 1/4"
JOIST SET BACK FOR A HIP ROOF OR FOR REGULAR RAFTER RUN

JOB SHEET #6

(NOTE: When roof trusses are used, the ceiling joists are eliminated. Roof trusses can usually be spaced at 2' centers. See Figure 2.)

FIGURE 2



JOB SHEET #6

2. For a hip roof

   a. Determine the direction joists will run (usually the short way of the structure)

   b. Locate the outside of the first joist 15-1/4" from the inside corner of the double plate

   c. Hold the 0 end of the 100-foot tape on the mark that was just made and proceed to mark sixteen-inch intervals on the plate moving from left to right; place an *X* to the right of each mark

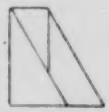
      (NOTE: The *X* designates the side of the mark on which the joist is placed.)

   d. Repeat Steps b and c on the opposite wall, reversing the procedure of measurement going from right to left

   e. Repeat steps b, c, and d on the end walls to receive short joist (Figures 3 and 3a)

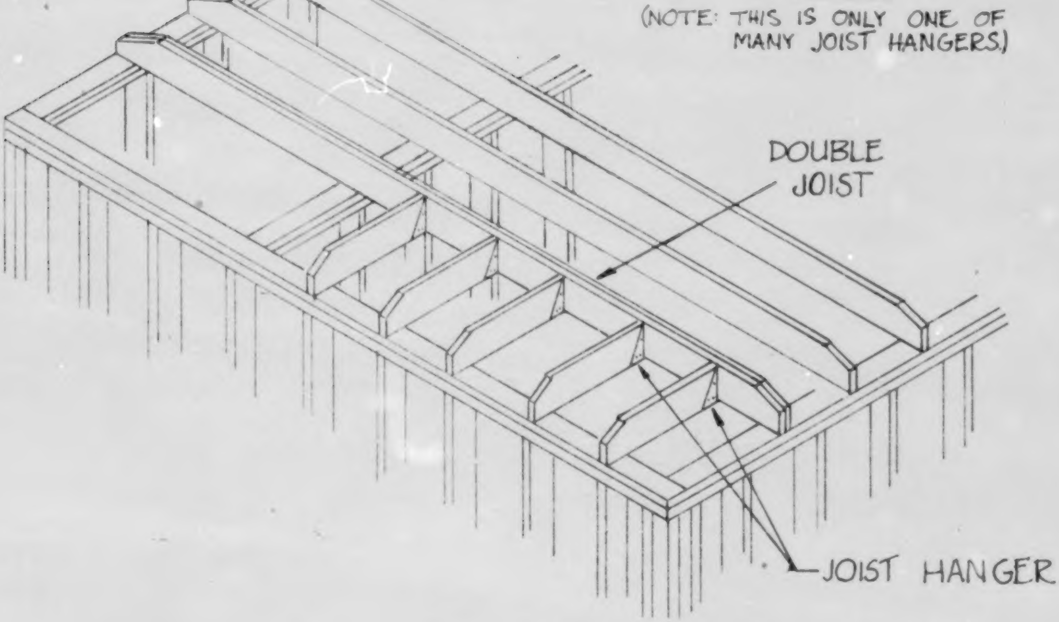
      (NOTE: Use joist hangers if required.)

FIGURE 3a



(NOTE: THIS IS ONLY ONE OF MANY JOIST HANGERS.)

FIGURE 3

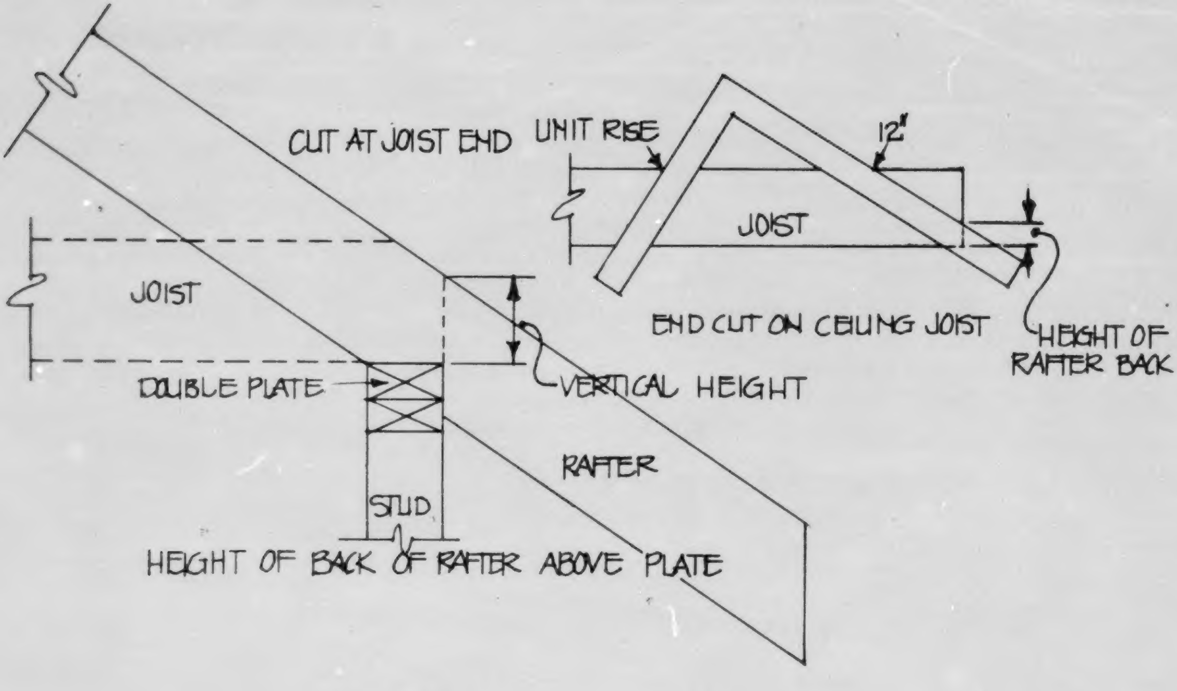


JOB SHEET #6

B. Install ceiling joist

1. Cut joist ends to the pitch of the roof (Figure 4)

FIGURE 4


CUT AT JOIST END
JOIST
DOUBLE PLATE
VERTICAL HEIGHT
RAFTER
STUD
HEIGHT OF BACK OF RAFTER ABOVE PLATE
UNIT RISE
12"
JOIST
END CUT ON CEILING JOIST
HEIGHT OF RAFTER BACK

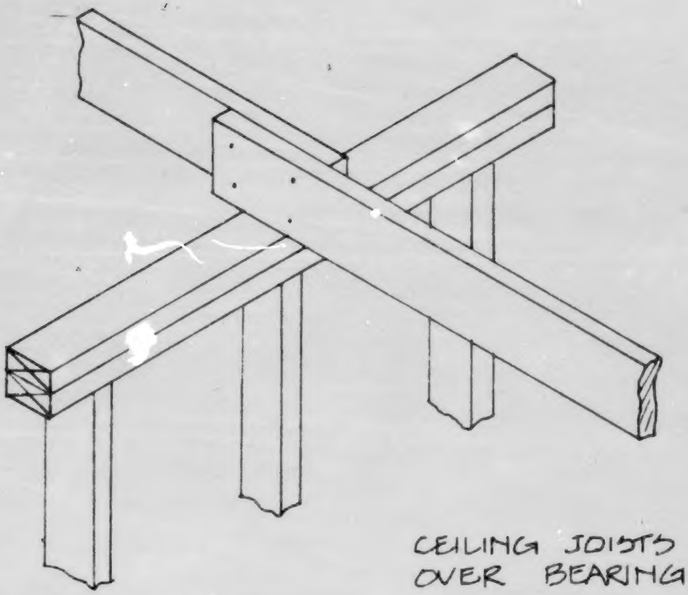
2. Place one joist, crown up, on each mark that was made on the plate

JOB SHEET #6

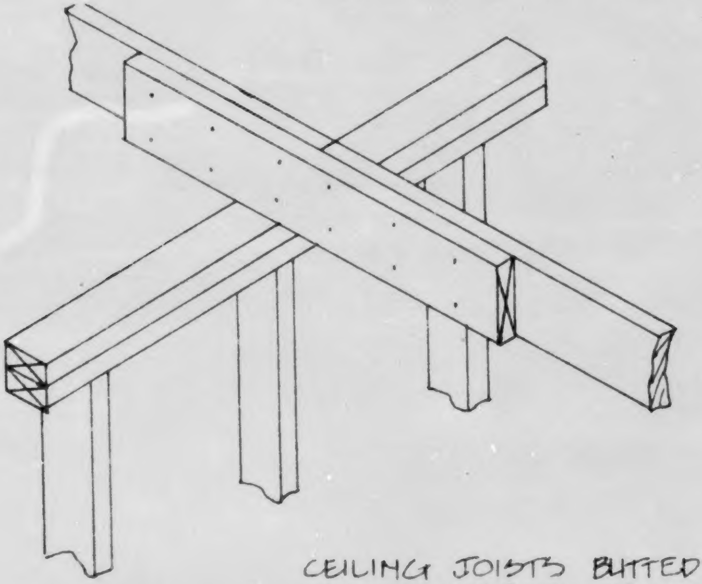
3. Splice joists on bearing walls (Figure 5)

   (NOTE: There should be a maximum of 6" overlap.)

FIGURE 5



CEILING JOISTS LAPPED
OVER BEARING PARTITION

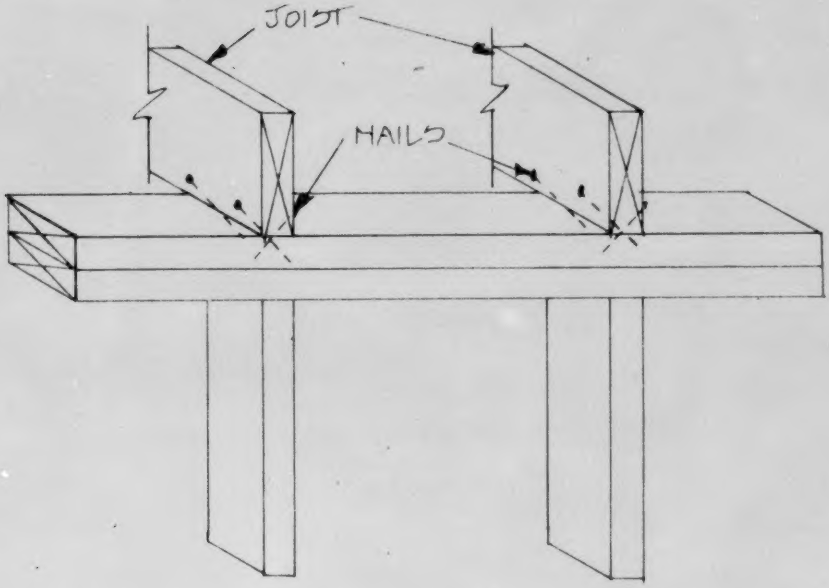


CEILING JOISTS BUTTED
OVER BEARING PARTITION

JOB SHEET #6

4. Toe nail joist to plate with three 16d box nails (Figure 6)

FIGURE 6


JOIST
NAILS

WALL AND PARTITION FRAMING
UNIT II

JOB SHEET #7--INSTALL WINDOWS

I. Tools and materials

  A. Tools

    1. Level, 3 or 4 foot

    2. Claw hammer

    3. Nail set

  B. Materials

    1. Window units

    2. Shim stock (usually wood shingles)

    3. Casing nails, 8d or 10d for wood window unit

    4. Nails, 8d box for aluminum unit

II. Procedure

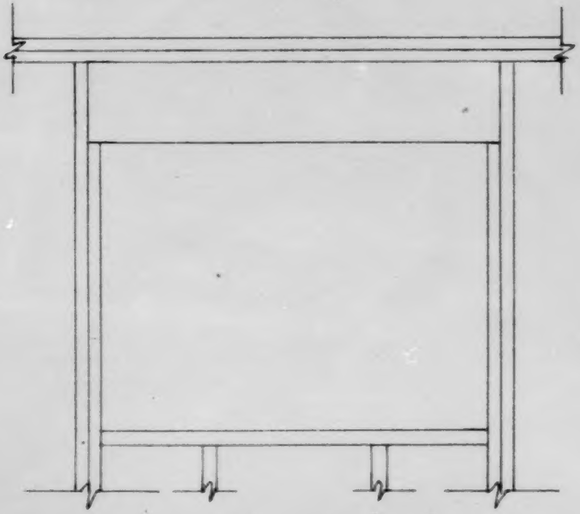
(NOTE: Check manufacturer's instructions. If they are sufficiently detailed, follow them. If not, proceed as follows.)

  A. Unpack window unit

  (NOTE: Leave all bracing intact for wood units.)

  B. Check rough opening size (Figure 1)

FIGURE 1



JOB SHEET #7

C. Set window unit in the opening from the outside

(NOTE: Have a helper hold the unit in place while checking to see that the sill is level and the sides are plumb. If the window unit is square, you should only need to level the sill.)

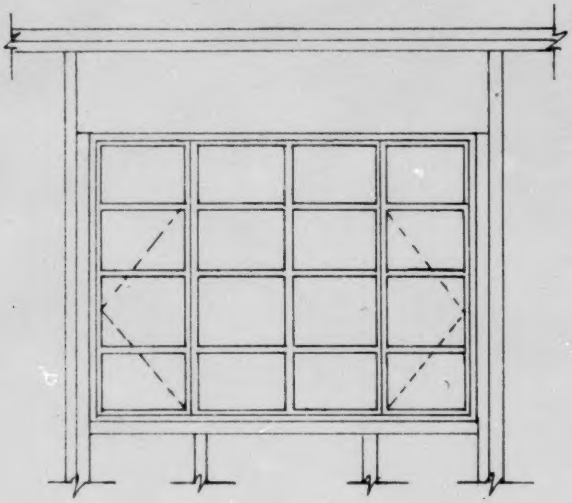
D. Adjust the window unit in the opening by using wood shingles as shims until the sill is level

E. Temporarily nail the unit in place through the outside casing

F. Open and close window to determine if the unit is in a bind; make adjustments if necessary

G. Nail the unit in place permanently (Figure 2)

FIGURE 2



WALL AND PARTITION FRAMING
UNIT II

JOB SHEET #8--INSTALL EXTERIOR DOOR FRAME AND HANG DOOR

(NOTE: Prehung doors are set very similarly; doors are predrilled for locks.)

I. Tools and materials

  A. Tools

    1. Level, 6 foot
    2. Claw hammer
    3. Framing square
    4. Butt gauge for four-inch butts
    5. Wood chisel, 1 inch
    6. Boring jig
    7. Mortising jig (if available) and router

  B. Materials

    1. Exterior jamb unit
    2. Shim stock (wood shingles)
    3. Nails, 10d casing and 8d box
    4. Butt hinges, 4-inch, 3
    5. Door
    6. Lock set

II. Procedure

  A. Install door frame

    1. Check rough opening size
    2. Cut out sill area so the top of the sill will be the correct distance above the rough floor
    3. Assemble the frame
    4. Place frame in rough opening; from the outside, center it horizontally and secure with a temporary brace

JOB SHEET #8

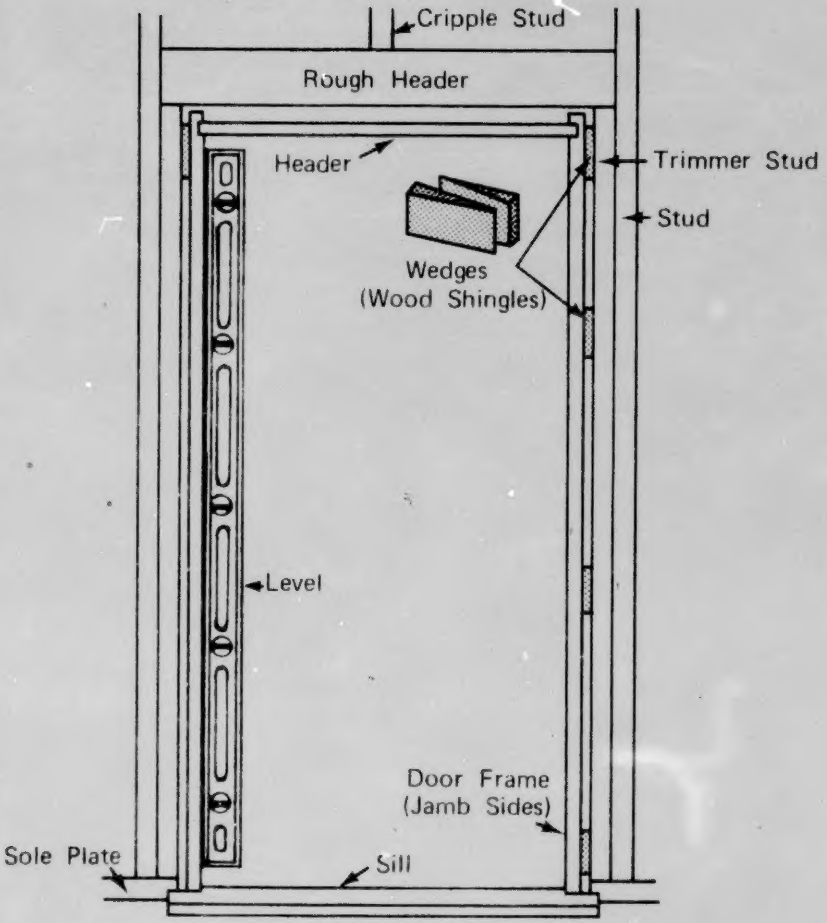
5. Use blocking and wedges to level the sill and bring it to the required height

   (NOTE: Be sure the sill is well supported.)

6. With the sill level, drive a nail through the exterior casing into the wall frame on both sides of the sill at the bottom of the frame

7. Insert shims between the trimmer studs and the top of the jambs and adjust until they are plumb; use the level (Figure 1)

FIGURE 1


Cripple Stud
Rough Header
Header
Trimmer Stud
Stud
Wedges
(Wood Shingles)
Level
Door Frame
(Jamb Sides)
Sole Plate
Sill

Plumbing Door Jambs

(NOTE: Casings are attached on prehung units; frame can be held plumb by nailing casing to stud.)

8. Place additional wedges between the jambs and stud frame in the area of the lock strike plate and hinges; adjust the wedges until the side jambs are well supported and straight; then nail in place through jamb, wedge, and into stud using 10d casing nails

9. Nail exterior casing in place using 8d box nails

B. Hang door

1. Use the butt gauge to mark the position for the three hinges on the jamb (usually seven inches from top, eleven inches from bottom, and centered in between)

   (NOTE: Be sure the correct side of the jamb is marked.)

2. Chisel out the gain to the correct depth for the hinges or use door hanging jig and router

3. Use the butt gauge again and mark the hinge locations on edge of door

   (NOTE: Check to be sure that top hinge is marked at top end of door. The top hinge must be marked 6 7/8" from the top of the door.)

   a. Transfer the measurements for the middle and bottom hinge to the edge of the door

   b. Cut gains with chisel

   c. Install hinges

   d. Hang door

4. Install lockset, usually 36" from bottom of door; use boring jig

WALL AND PARTITION FRAMING
UNIT II

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided. Terms and definitions are continued on the next page.

_____a. Lower framing member which is attached to the top of the bottom cripple studs and forms the base of a rough opening for a window

_____b. Wall which supports the floors and/or roof directly above it in addition to its own weight

_____c. Lowest horizontal member of a wall or partition which rests on the rough floor to which the studding is nailed

_____d. Use of wood blocks as filler pieces between the framing members

_____e. Opening for doors and windows formed by the framing members

_____f. Top and two sides of a door or window frame which contact the door or sash, consisting of a head jamb and two side jambs

_____g. Any part of a framing stud that is cut less than full size, as over a door or window opening and under a window opening

_____h. Wall that subdivides space within a building

_____i. Main vertical framing members in walls and partitions

_____j. Topmost member of a wall section attached to the top of the studs for the purpose of stiffening the wall and for tying together splices, corners, and partitions that are at right angles to a wall

1. Bearing wall
2. Blocking
3. Cripple stud
4. Double plate
5. Jamb
6. Partition
7. Rough opening
8. Rough sill
9. Sole plate
10. Stud

_____k. Vertical members that form the sides of a rough opening for a door or window upon which the header rests

_____l. Horizontal structural member that supports the load over an opening, such as a window or door

_____m. Partition wall which supports the structure above

_____n. Usually a 2 x 4 about 16" long used as a spacer between studs to form corners and partition T's

_____o. End of building; triangular end of an exterior wall above the eaves

_____p. Various types of material designed to use on exterior of a structure

11. Bearing partition
12. Trimmer
13. Spacer
14. Gable
15. Sheathing
16. Header

2. Identify the framing members used in wall and partition construction. Write the correct names in the blanks provided.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

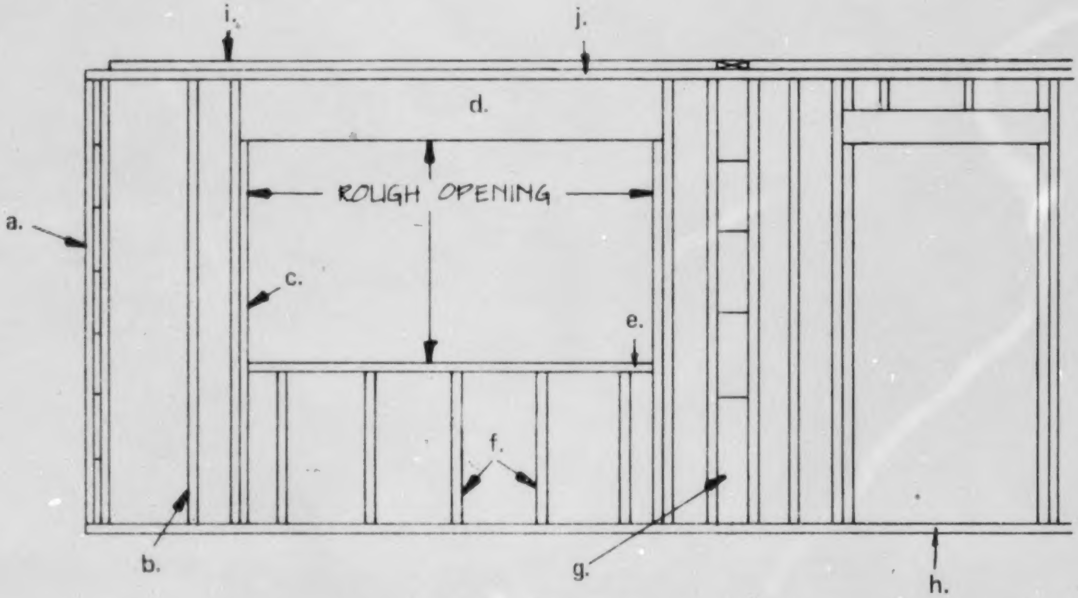
f. ______________________

g. ______________________

h. ______________________

i. ______________________

j. ______________________



3. Compute the length of regular stud for a finished ceiling height of 8'-1/2" on a conventional wood floor with 1/2" dry wall ceiling.

4. Compute the length of the trimmers for a standard 6'-8" door opening on a concrete floor.

5. Compute the length of the rough header for a 2'-8" x 6'-8" door.

6. Name types of sheathing.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

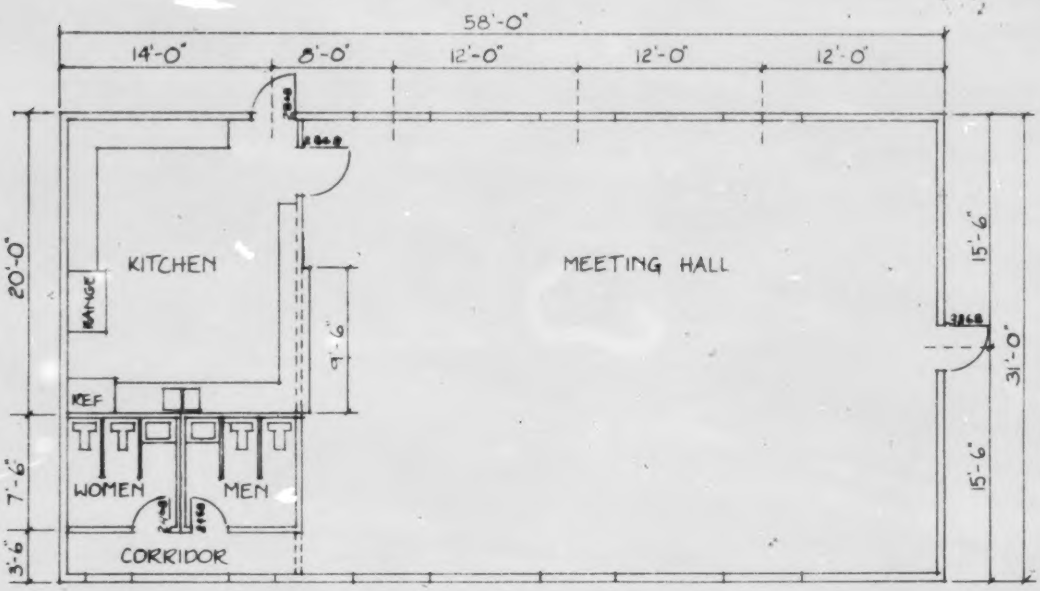
e. ______________________________

7. Estimate the amount of the following materials for the floor plan pictured below.

   a. Studs 16" on centers ______________________

   b. Plates ______________________

   c. Sheathing (plywood) ______________________


58'-0"
14'-0"
8'-0"
12'-0"
12'-0"
12'-0"
20'-0"
7'-6"
3'-6"
KITCHEN
RANGE
REF
9'-6"
MEETING HALL
15'-6"
15'-6"
31'-0"
WOMEN
MEN
CORRIDOR

8. Demonstrate the ability to:

   a. Lay out wall and partition locations on floor.

   b. Cut studs, trimmers, cripples, and headers to length.

   c. Build corners, T's, and headers.

   d. Construct wall sections for a single-story structure.

   e. Install sheathing.

f. Lay out and install ceiling joists.

g. Install windows.

h. Install exterior door frame and hang door.

(NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

WALL AND PARTITION FRAMING
UNIT II

ANSWERS TO TEST

1. a. 8
   b. 1
   c. 9
   d. 2
   e. 7
   f. 5
   g. 3
   h. 6
   i. 10
   j. 4
   k. 12
   l. 16
   m. 11
   n. 13
   o. 14
   p. 15

2. a. Corner assembly
   b. Regular stud
   c. Trimmer stud
   d. Header
   e. Rough sill
   f. Cripple studs
   g. Blocking
   h. Sole plate
   i. Double top plate
   j. Top plate

3. 7'-9 1/8"

4. 6'-8 5/8"

5. 3'-1 3/4"

6. a. Gyplap
   b. Fiberboard
   c. Plywood
   d. Styrofoam
   e. 1 x 6's (diagonal, horizontal, or vertical)

7. a. 249 studs
   b. 47 - 2 x 4's - 16'
   c. 45 pieces, 1/2" x 4' x 8' plywood
8. Performance skills evaluated to the satisfaction of the instructor

ROOF FRAMING
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the roofing members and roof styles and list the methods for determining rafter length. The student should be able to cut and assemble the various roof members and apply roof sheathing. This knowledge will be evidenced by completion of the assignment sheets, job sheets, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with roof framing to the correct definitions.
2. Identify roofing members.
3. Identify roof styles.
4. Match roof framing units to their descriptions.
5. List methods for determining the length of a rafter.
6. Compute the length of a common rafter using the framing square.
7. Compute the length of a hip rafter using the framing square.
8. Compute the length of jack rafters using the difference in length tables on the framing square.
9. Estimate the material needed to frame a roof.
10. Demonstrate the abilty to:
    a. Lay out rafter locations on the plate and ridge on two-foot centers.
    b. Lay out, cut, and erect rafters.
    c. Apply roof sheathing.

ROOF FRAMING
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Provide students with framing squares and rafter table booklets to complete assignment sheets and job sheets.

   H. Give test.

II. Instructional materials

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Roofing Members

      2. TM 2--Roof Styles

      3. TM 3--Framing Square Step-Off Method

      4. TM 4--Rafter Tables from a Framing Square

      5. TM 5--The Framing Square

      6. TM 6--Common Rafter Layout

      7. TM 7--Length of Ridge Board

   D. Assignment sheets

      1. Assignment Sheet #1--Compute Rafter Length

      2. Assignment Sheet #2--Estimate Roof Framing Materials

E. Answers to assignment sheets

F. Job sheets

1. Job Sheet #1--Lay Out Rafter Locations on the Plate and Ridge on Two-Foot Centers

2. Job Sheet #2--Lay Out, Cut, and Erect Rafters

3. Job Sheet #3--Apply Roof Sheathing

G. Test

H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

B. Cooper, George H., and Badzinski, Stanley Jr. *Building Construction Estimating*. St. Louis, Missouri: McGraw-Hill, 1971.

C. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry*. 3rd ed. Chicago: American Technical Society, 1963.

D. Feirer, John L. *Woodworking for Industry*. Peoria, Illinois: Charles Bennett Company, Inc., 1971.

E. *Suggested Basic Course Outline in Carpentry*. Stillwater: Oklahoma State Department of Vocational and Technical Education, Trade and Industrial Education.

F. Smith, Ronald C. *Principles and Practices of Light Construction*. Englewood Cliffs, New Jersey: Prentice Hall Inc., 1970.

G. Riechers, A. F. J. *Full Length Roof Framer*. Palo Alto, California: Lederer, Street, and Zeus Co., Inc., 1944.

ROOF FRAMING
UNIT III

INFORMATION SHEET

I. Terms and definitions

A. Barge rafter--Exposed rafter at the end of a gable roof; sometimes called a *verge rafter*

B. Birdsmouth--Cutout near the bottom of a rafter which fits over the double plate

C. Collar beam--Horizontal tie beam connecting two opposite rafters up near the ridge to hold them together at the ridge

D. Common rafter--One of a series of rafters extending from the double plate to the ridge

E. Dormer--Vertical window in a roof

F. Gusset--Panel or bracket of either wood or metal attached to the corners at intersections of a frame to add strength and stiffness

G. Hip rafter--Rafter extending from the double plate at the corner of a structure to the ridge, forming the angle for a hip roof

H. Jack rafter--Short rafter which fits between the plate and the hip or valley rafter or between the ridge and hip or valley rafter

(NOTE: When fitted between hip and valley rafter, it is called a *cripple jack*.)

I. Pitch--Angle or degree of slope of a roof

J. Plumb cut--Cut at right angles to the seat cut of the birdsmouth; cut of the rafter at the ridge

K. Purlin--Horizontal timbers supporting the common rafters in roofs

L. Ridge board--Horizontal member or timber at the top of the roof to which the upper end of the rafters are nailed

M. Rise--Incline or pitch of a roof expressed in terms of inches per one foot of run

N. Run--Horizontal distance that underlies the slope of the roof from a wall to the ridge, usually one-half of the span

O. Seat cut--Cut at the lower end of a rafter; the part of the birdsmouth that rests on the plate

INFORMATION SHEET

P. Span--Horizontal distance that underlies the roof from outside of one exterior wall to outside of opposite exterior wall

Q. Valley rafter--Rafter used in an internal angle of a roof to form a valley

II. Roofing members (Transparency 1)

A. Collar beam

B. Common rafter

C. Hip rafter

D. Ridge board

E. Valley rafter

F. Gable stud

G. Hip jack

H. Valley jack

I. Overhang

J. Plate

III. Roof styles (Transparency 2)

A. Gable

B. Hip

C. Shed or lean-to

D. Flat

E. Gable and dormer

F. Mansard

G. Gambrel

IV. Roof framing units

A. Unit span--Always equals twenty-four inches

B. Unit rise--Changes with slope or pitch

C. Unit run--Always equals twelve inches

D. Unit length--Increases with rise

INFORMATION SHEET

V. Methods for determining rafter length (Transparencies 3 and 4)

   A. Framing square step-off method

   B. Rafter tables from framing square

      (NOTE: Rafter tables are usually in length per foot of run although some tables are in length per given run.)

VI. Computing the length of a common rafter using the framing square

   (NOTE: Refer to fold-out of framing square at end of information sheet.)

   A. Determine the common rafter layout--Measure from the outside of the plate on one side wall to the outside of the plate on the opposite side wall (Transparency 5)

   B. Determine the run of the common rafter

      (NOTE: Run equals one-half of span.)

      1. Divide the span by two

      2. Subtract one-half the thickness of the ridge board

         (NOTE: This is commonly called *shortening*.)

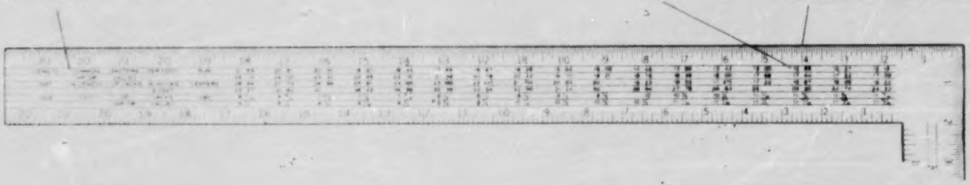
   C. Determine the pitch of the roof or the rise per foot of run

   D. Read the length of the rafter per foot of run from framing square

      (NOTE: Refer to framing square at end of information sheet.)

      1. Locate the unit rise per foot of run on the blade of the framing square

         Example: If the unit rise is four inches per one foot of run, locate the number four on the edge of the blade



Line 1 = Common Rafters Per Foot of Run

12.65 Inches Unit Length Per Foot Run in Inches and Hundredths of an Inch

4 Inches Unit Rise Per Foot of Run

INFORMATION SHEET

2. Read the figure under the unit rise for the unit length per foot of run for the common rafter

   (NOTE: In the illustration, this figure is 12.65 inches per foot of run.)

3. Multiply the unit length per foot of run by the actual run

   Example: If the run of the building for the illustration given is ten feet, multiply 10 x 12.65 = 126.50 inches or 10 54/100 feet or 10'-6 1/2" This is the length of the common rafter. The formula for this procedure is:

   $$\frac{\text{Feet of Run} \times \text{Inches Per Foot of Run}}{12''}$$

   (NOTE: The following table may be used to convert decimals to inches.)

   1 inch equals 0.083 foot
   2 inches equals 0.167 foot
   3 inches equals 0.250 foot
   4 inches equals 0.333 foot
   5 inches equals 0.417 foot
   6 inches equals 0.500 foot
   7 inches equals 0.583 foot
   8 inches equals 0.667 foot
   9 inches equals 0.750 foot
   10 inches equals 0.833 foot
   11 inches equals 0.917 foot

VII. Computing the length of a hip rafter using the framing square

A. Determine the span, run, and rise the same as for the common rafter

B. Read the length of the hip or valley rafter per foot of run from the framing square

   (NOTE: Refer to framing square at end of information sheet.)

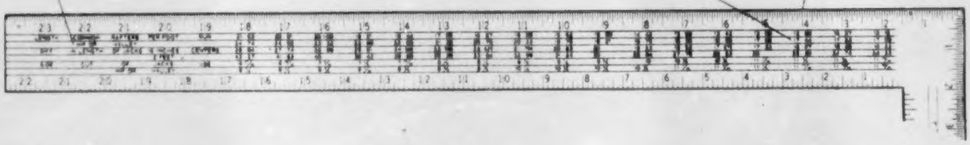
   1. Locate the unit rise per foot of run on the blade of the framing square the same as for a common rafter

      (NOTE: See the illustration for common rafters on the preceeding page.)

INFORMATION SHEET

2. Read the figure under the unit rise for the length of hip or valley rafters per foot of run of common rafter

   (NOTE: See the illustration below for the inches in rise per foot of run for a hip or valley with a four-inch rise per foot of run.)



Length of Hip or Valley Rafter Per Foot of Run

17.44 Inches Unit Length Per Foot of Run in Inches and Hundredths of an Inch

4 Inches Unit Rise Per Foot of Run

3. Determine the length of the hip or valley rafter by multiplying the unit length per foot of run by the feet of run and divide by twelve, the same as for the common rafter

   (NOTE: Use the same formula as in computing the common rafter as shown in the illustration.)

$$\frac{\text{Inches Per Foot Run} \times \text{Feet of Run of the Common Rafter}}{12''}$$

$$\frac{17.44 \times 10}{12} = \frac{174.4}{12} \text{ inches}$$

   174.4 inches = 14'-6 3/8" length of hip or valley rafter; shorten by one-half the diagonal thickness of the ridge board

VIII. Computing the length of jack rafters using the framing square

(NOTE: The rise per foot of run is the same as for common rafters.)

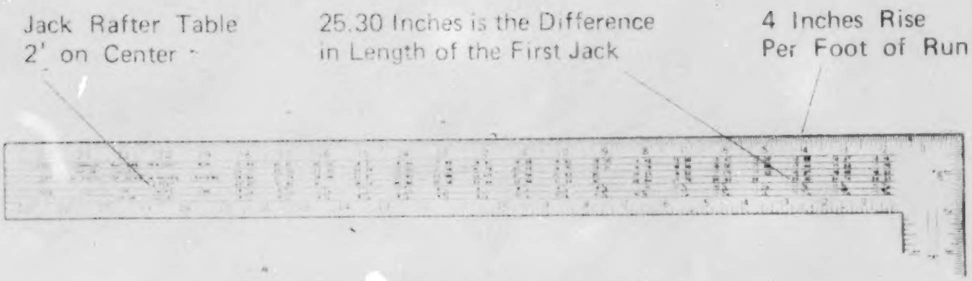
A. Locate the table for jacks on two-foot centers on the blade of the framing square

   (NOTE: Refer to framing square at end of information sheet.)

B. Locate the rise per foot of run on the edge of the blade

INFORMATION SHEET

C. Read across and down to the number listed


Jack Rafter Table
2' on Center
25.30 Inches is the Difference
in Length of the First Jack
4 Inches Rise
Per Foot of Run

D. For a roof of four inches rise per foot of run, the length of the first jack rafter from the table is 25.30 inches or 25 3/8" shorter than the common rafter

E. Second jack will be two times shorter than the first jack or 50 3/4" shorter than the common rafter

F. Third jack will be three times shorter than the first jack or 76 1/8" shorter than the common rafter

G. Fourth jack will be four times shorter than the first and the fifth will be five times shorter and continued until the number needed is reached

IX. Estimating roof framing materials

A. Gable roof with rafters two feet on center

1. Rafters--For a simple rectangular building

a. Determine the length of the rafter, including overhang

(NOTE: Refer to Transparency 5 or framing square at end of information sheet.)

b. Determine the number needed

1) Measure the length of one side of the building and round up to the nearest foot

2) Add six additional rafters, two for end rafters and four for barge rafters

INFORMATION SHEET

2. Ridge board (Transparency 6)

   (NOTE: The ridge should be the next dimension longer than the rafter material.)

   a. Gable roof--Determine the length of the plate on one side of the building and add the amount of projection over each gable end for a simple rectangular building

   b. Hip roof

      1) Measure the length of the building

      2) Measure the width of the building

      3) Subtract the width from the length and add the thickness of the ridge to the remainder for the actual ridge length

B. Hip roof with rafters two feet on center--Rafters for a simple rectangular building

(NOTE: Refer to Transparency 5 or framing square on next page.)

1. Determine the length of the common rafters including overhang

2. Determine the length of the hip rafters including overhang

   (NOTE: Jack rafters are simply common rafters that have been shortened.)

3. Determine the number of rafters needed for a simple rectangular hip roof

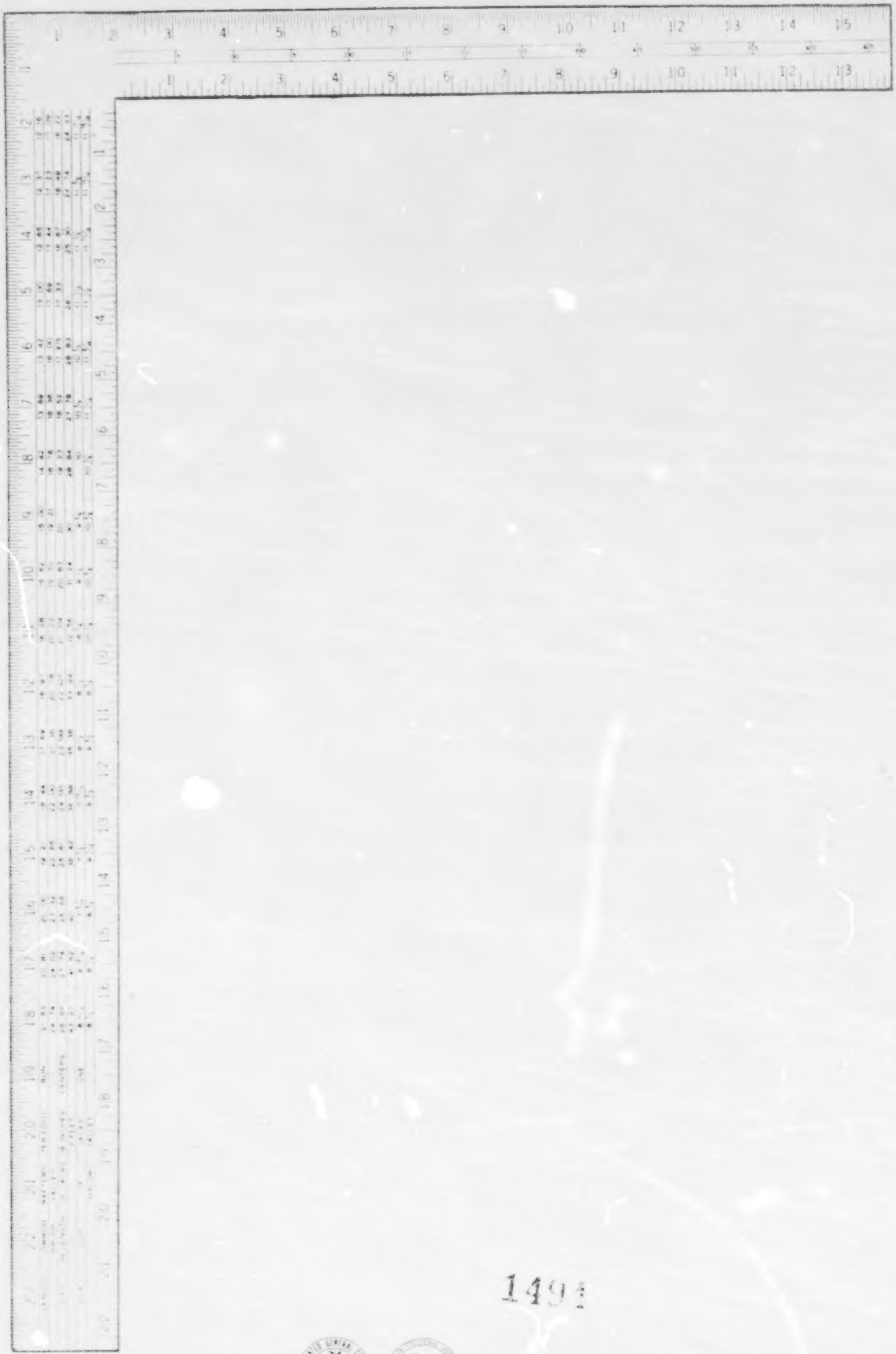
   a. Hip rafters--One for each corner

   b. Common and jack rafters--Measure the length of the building, round up to the nearest foot, and add two end rafters or four for barge rafters as in a gable roof

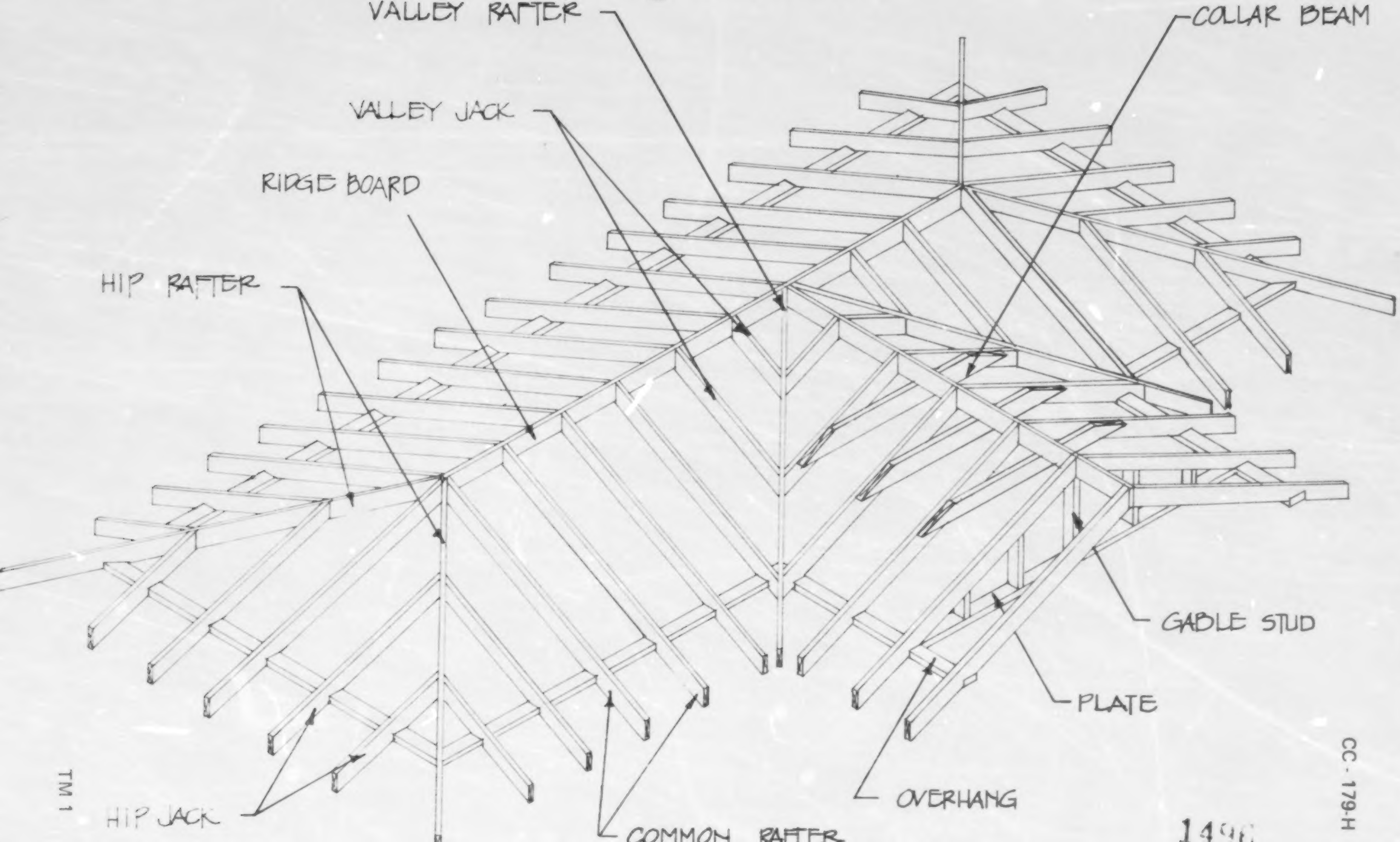
      (NOTE: The same amount of material is needed for rafters for either a gable or hip roof.)

CC - 177-H

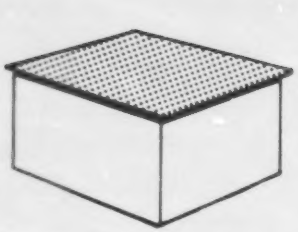
INFORMATION SHEET


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2 3 4 5 6 7 8 9 10 11 12 13
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

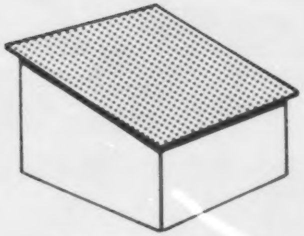
Roofing Members


VALLEY RAFTER
COLLAR BEAM
VALLEY JACK
RIDGE BOARD
HIP RAFTER
GABLE STUD
PLATE
OVERHANG
HIP JACK
COMMON RAFTER

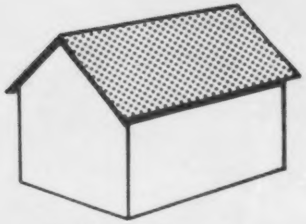
Roof Styles



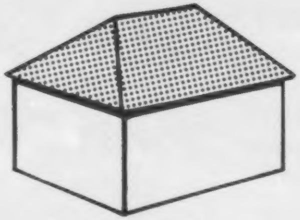
Flat Roof



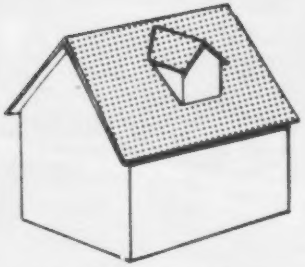
Shed or
Lean-To Roof



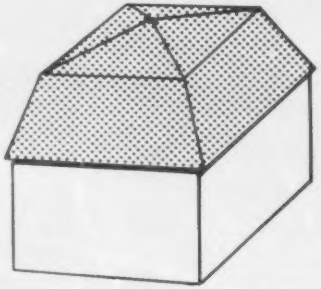
Gable Roof



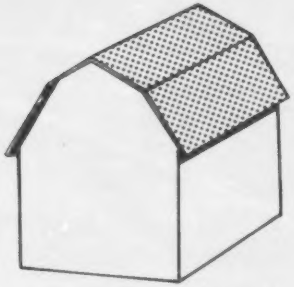
Hip Roof



Gable Roof
and Dormer

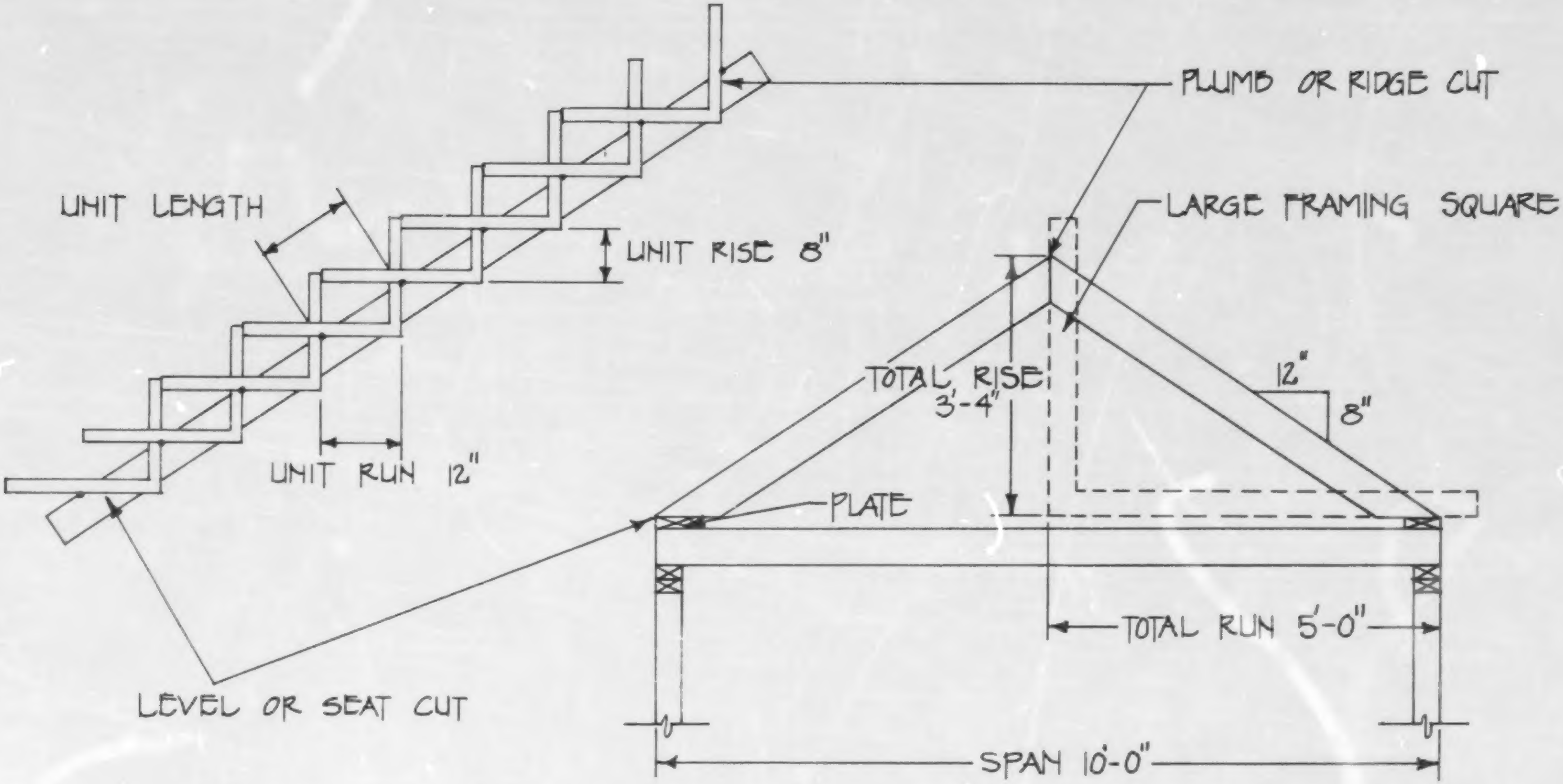


Mansard Roof



Gambrel Roof

Framing Square Step-Off Method

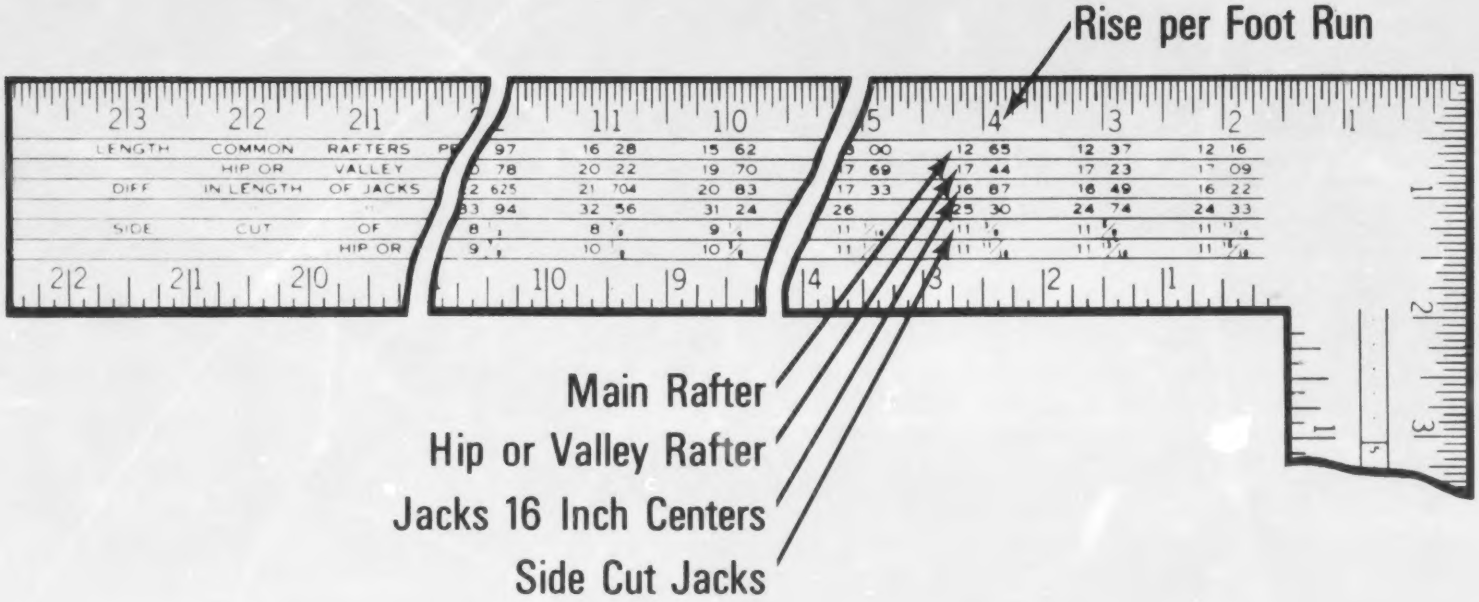

PLUMB OR RIDGE CUT
LARGE FRAMING SQUARE
UNIT LENGTH
UNIT RISE 8"
TOTAL RISE 3'-4"
12"
8"
UNIT RUN 12"
PLATE
TOTAL RUN 5'-0"
LEVEL OR SEAT CUT
SPAN 10'-0"

SCALE: 1/2" = 1'-0"

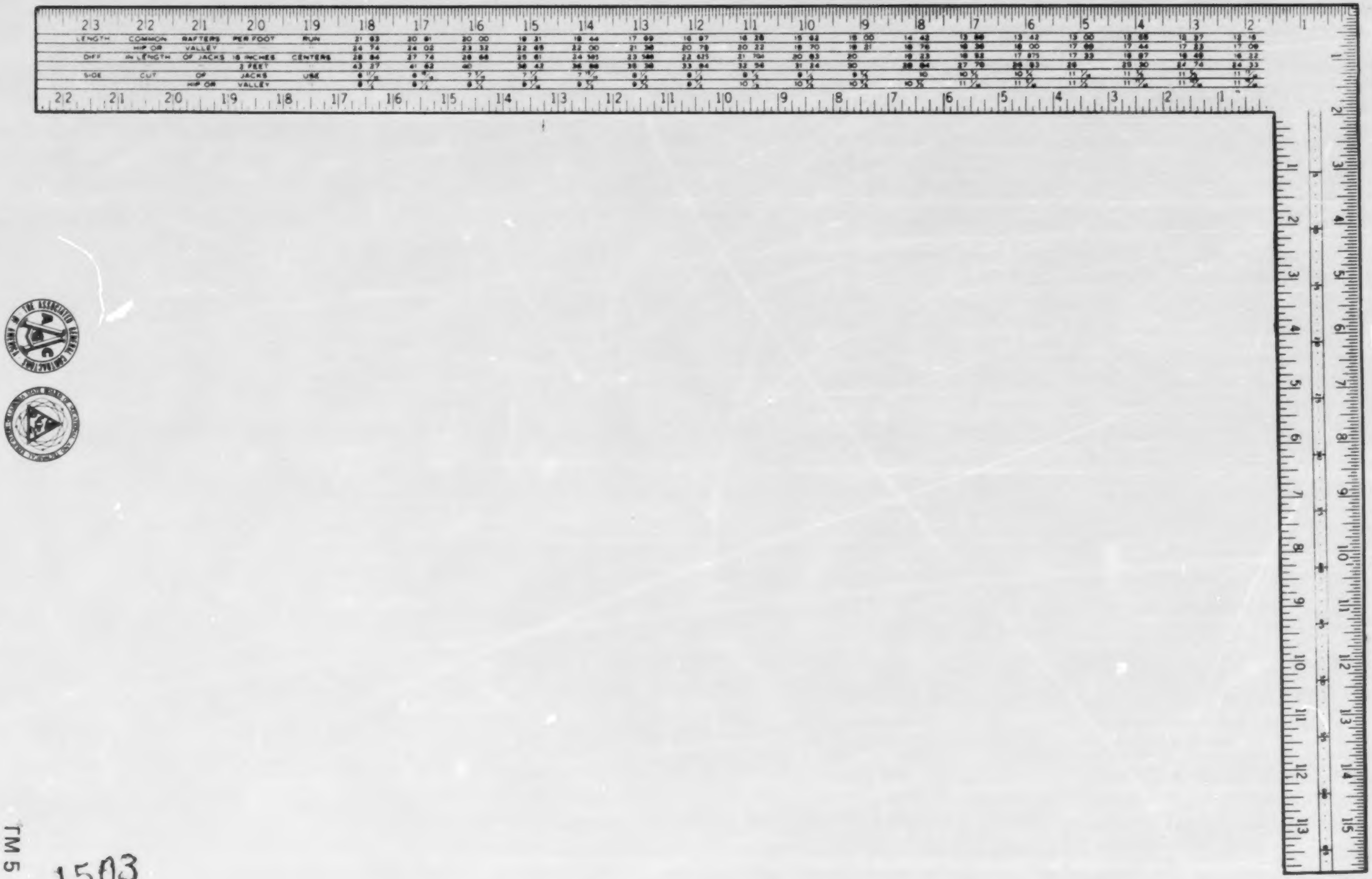
TM 3

CC-183-H

Rafter Tables From a Framing Square


Rise per Foot Run
Main Rafter
Hip or Valley Rafter
Jacks 16 Inch Centers
Side Cut Jacks

The Framing Square


LENGTH COMMON RAFTERS PER FOOT RUN
HIP OR VALLEY
DIFF IN LENGTH OF JACKS 16 INCHES CENTERS
2 FEET
SIDE CUT OF JACKS USE
HIP OR VALLEY

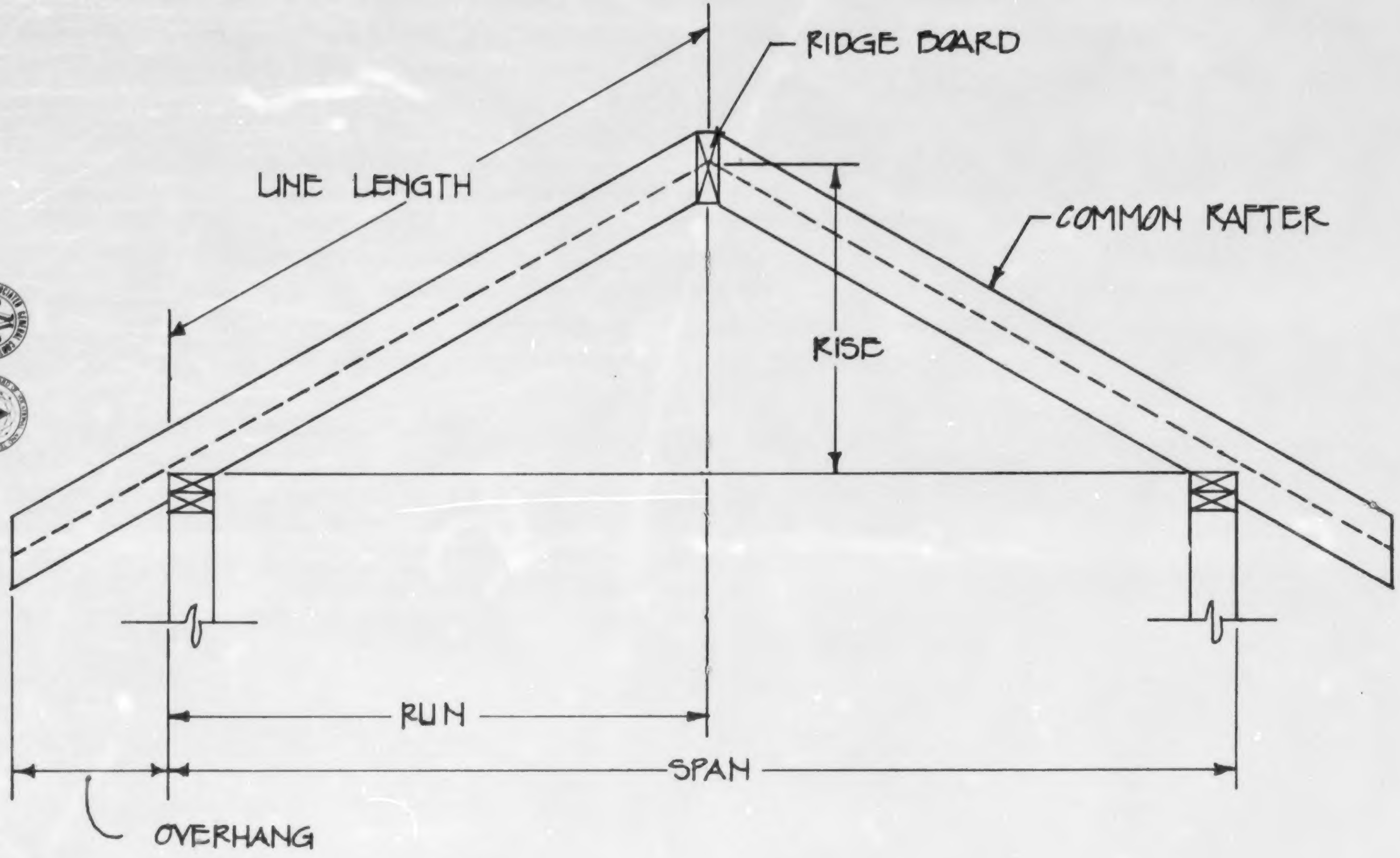
TM 5

1503

CC - 187-H

1504

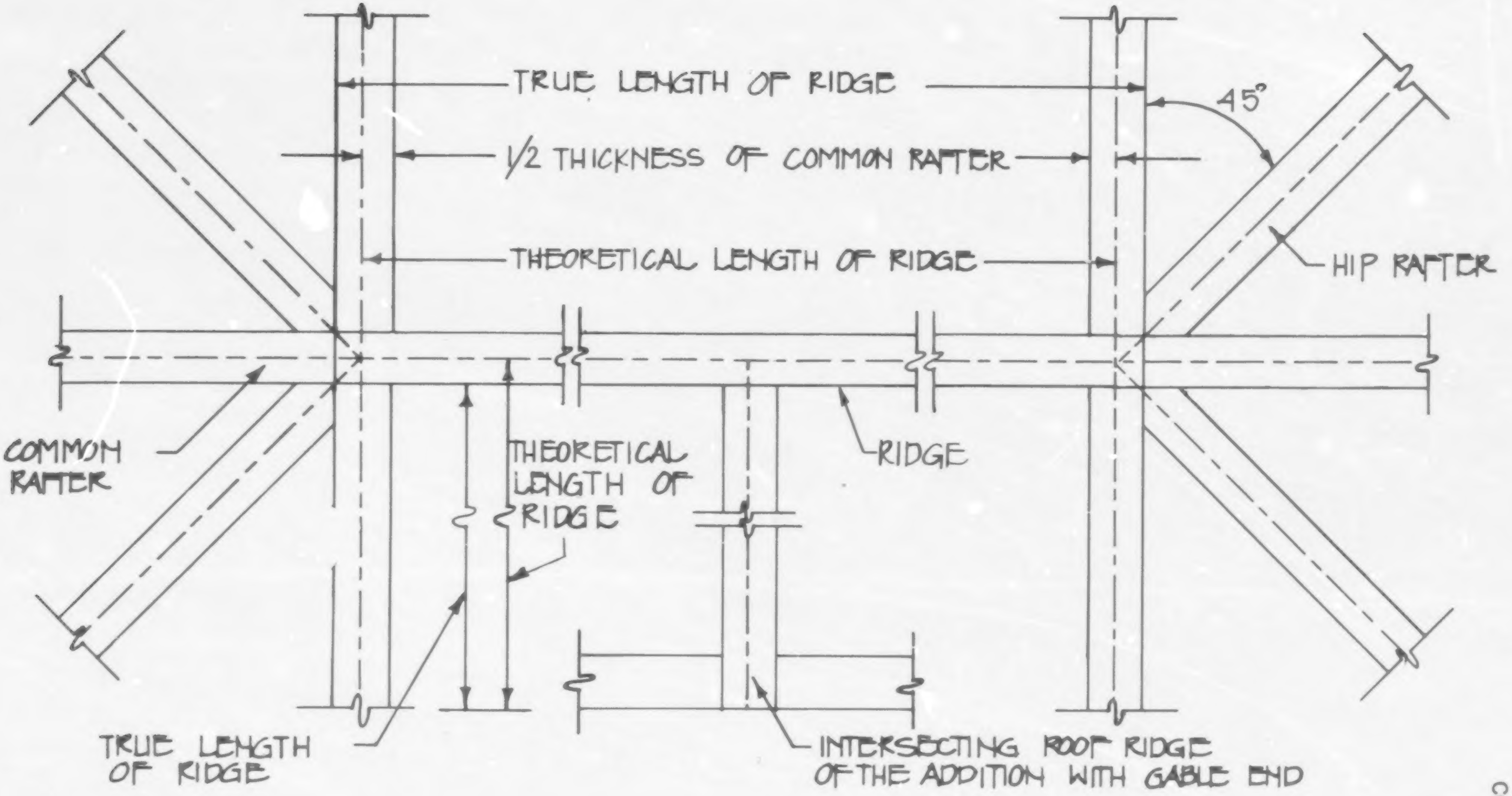
Common Rafter Layout


RIDGE BOARD
LINE LENGTH
COMMON RAFTER
RISE
RUN
SPAN
OVERHANG

1505

1506

Length of Ridge Board


TRUE LENGTH OF RIDGE
45°
1/2 THICKNESS OF COMMON RAFTER
THEORETICAL LENGTH OF RIDGE
HIP RAFTER
COMMON RAFTER
THEORETICAL LENGTH OF RIDGE
RIDGE
TRUE LENGTH OF RIDGE
INTERSECTING ROOF RIDGE OF THE ADDITION WITH GABLE END

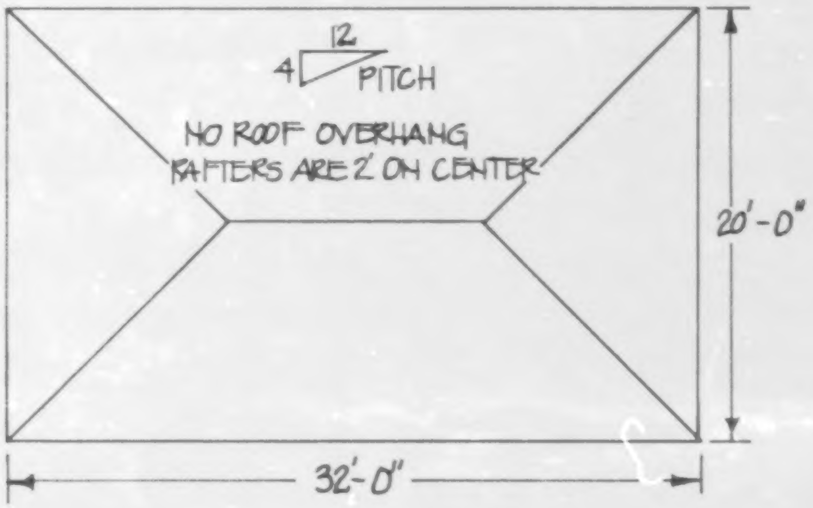
ROOF FRAMING
UNIT III

ASSIGNMENT SHEET #1--COMPUTE RAFTER LENGTH

Using your information sheet and a framing square, calculate the length of the following roof members for the building illustrated below.

(NOTE: All material should be 2 x 6.)

1. Common - ______________________
2. Hip - ______________________
3. Third jack - ______________________
4. Ridge board 2 x 6 x ______________________



NO ROOF OVERHANG
RAFTERS ARE 2' ON CENTER

ROOF FRAMING
UNIT III

ASSIGNMENT SHEET #2--ESTIMATE ROOF FRAMING MATERIALS

Using your information sheet and a framing square, calculate the material needed to frame the roof illustrated below.

(NOTE: All material should be 2 x 6.)

1. Number and length of common rafter ____________________

2. Number and length of hip rafter ____________________

3. Number and lengths of each jack:

   #1 ____________________

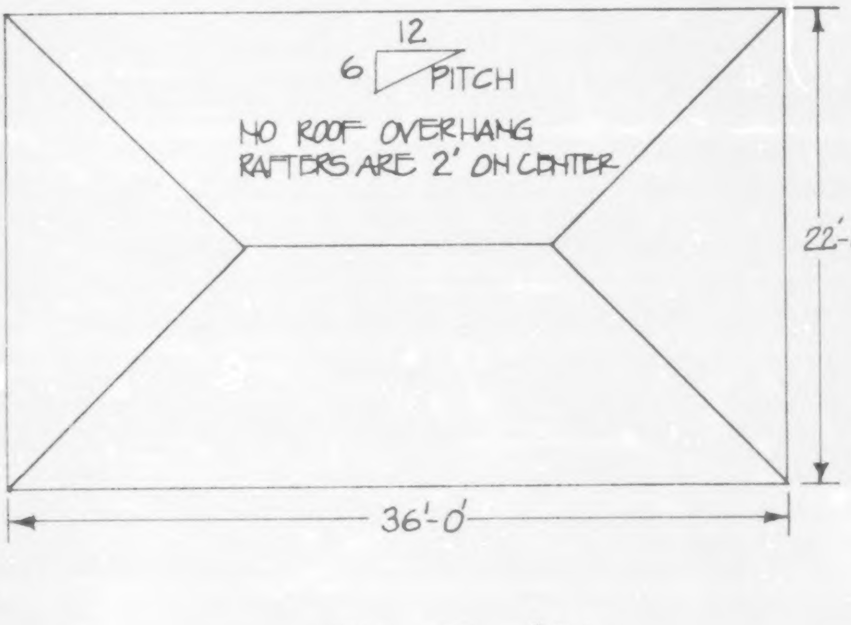
   #2 ____________________

   #3 ____________________

   #4 ____________________

   #5 ____________________

4. Length of ridge board ____________________


12
6
PITCH
NO ROOF OVERHANG
RAFTERS ARE 2' ON CENTER
22'-0"
36'-0"

ROOF FRAMING
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1. 10'-6 1/2"
2. 14'-6 3/8"
3. 4'-2 3/8"
4. 12'-1 1/2"

Assignment Sheet #2

1. 18 - 2 x 6 x 12'-3 5/8"
2. 4 - 2 x 6 x 13'-6"
3. #1--8 - 2 x 6 x 10'-0 3/4"

   #2--8 - 2 x 6 x 7'-9 7/8"

   #3--8 - 2 x 6 x 5'-7"

   #4--8 - 2 x 6 x 3'-4 1/8"

   #5--8 - 2 x 6 x 1'-1 1/8"
4. 1 - 2 x 6 x 14'-1 1/2"

ROOF FRAMING
UNIT III

JOB SHEET #1--LAY OUT RAFTER LOCATIONS ON THE PLATE AND RIDGE ON TWO-FOOT CENTERS

I. Tools and materials

- A. Tools
    - 1. Steel tape, 100 foot
    - 2. Framing square
- B. Materials
    - 1. Completed wall sections with double plate
    - 2. Ridge board

      (NOTE: This should be the next dimension longer than rafter material.)

II. Procedure

- A. Gable roof (with box cornice)
    - 1. Cut ridge board to correct length, allowing for barge rafter at each end if used
    - 2. Lay out rafter locations on double top plate
        - a. Begin at one end of plate and locate the first rafter flush with the end of the plate
        - b. Use the 100-foot tape with the 0 end held against the outside end of the wall and proceed to mark two-foot locations on the plate from left to right

          (NOTE: Place an *X* to the right of each mark.)
        - c. Set last rafter flush with the outside of the opposite end of the building

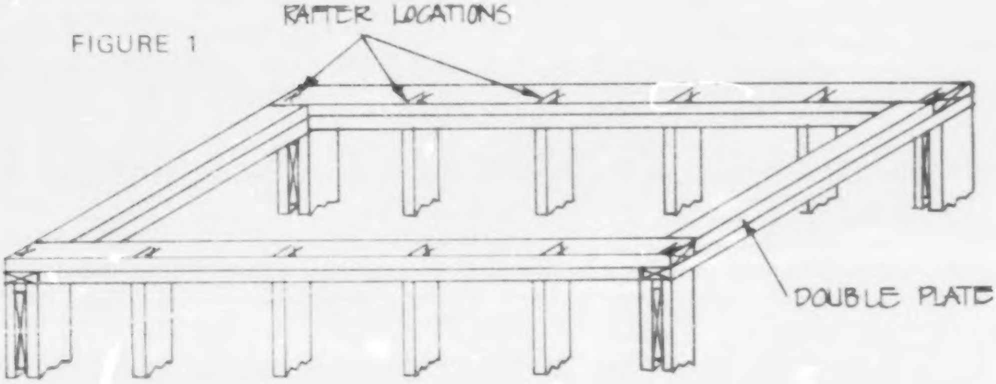
          (NOTE: The spacing between the last two rafters may be less than but not more than two feet.)
        - d. Use the framing square to square a line across the plate at each two-foot mark

JOB SHEET #1

e. Repeat the marking process on the opposite plate, being sure to start from the same end of the building; work from right to left (Figure 1)

(NOTE: See Figure 1 for the plate markings.)

FIGURE 1



3. Lay out ridge board

   a. Place ridge board on edge on top of the plate with equal projection over each end for the barge rafters

   b. Mark the ridge board on both sides to correspond to the marks on the plate

   c. Use the framing square to square lines across the face of the ridge board at each mark and place an *X* on the same side of the mark as on the plate

B. Hip roof

1. Cut ridge board to correct length

   a. Measure the length of the side wall from the outside of the opposite end plate

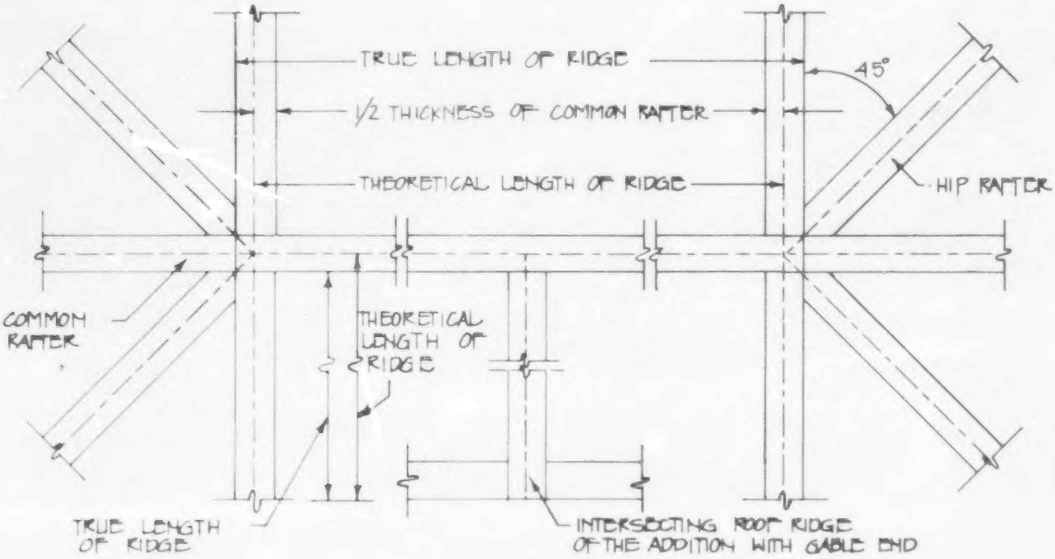
   b. Measure the length of one end wall from the outside of the opposite side plate

   c. Subtract b from a and add the thickness of the ridge for the true ridge length

JOB SHEET #1

d. Measure and cut ridge board to this length (Figure 2)

FIGURE 2


TRUE LENGTH OF RIDGE
1/2 THICKNESS OF COMMON RAFTER
THEORETICAL LENGTH OF RIDGE
45°
HIP RAFTER
COMMON RAFTER
THEORETICAL LENGTH OF RIDGE
TRUE LENGTH OF RIDGE
INTERSECTING ROOF RIDGE OF THE ADDITION WITH GABLE END

2. Lay out rafter locations on plate

   a. Measure one-half the width of the building from the end on the top plate of one side wall

      (NOTE: This locates the center of the first rafter.)

   b. Mark one-half the thickness of the rafter on either side of this line

   c. Space all other rafters, both common and jacks, from this rafter and mark their location by squaring a line across the plate with an *X* on one side of the line to indicate the side on which the rafter is to be placed

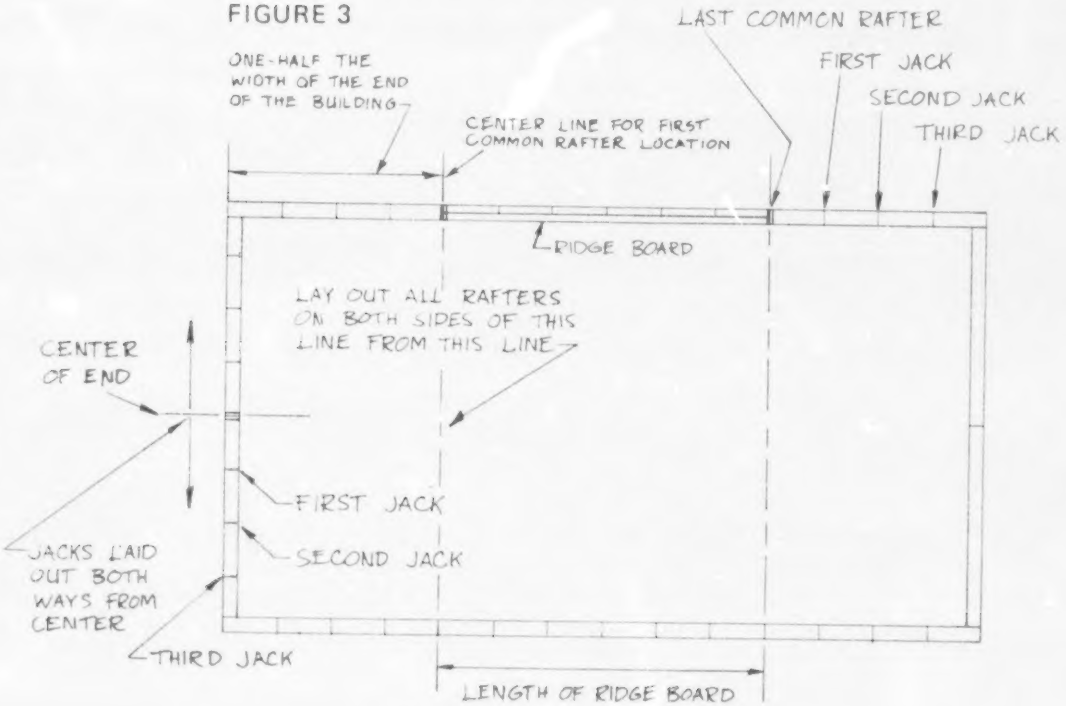
   d. Repeat the procedure for the opposite side

   e. Lay out the end from the center of the end wall both ways

JOB SHEET #1

f. Transfer the plate markings to the ridge board by holding one edge on the plate with one end flush with the outside mark for the first common rafter and marking each location on both sides of the ridge board (Figure 3)

FIGURE 3


ONE-HALF THE WIDTH OF THE END OF THE BUILDING
CENTER LINE FOR FIRST COMMON RAFTER LOCATION
LAST COMMON RAFTER
FIRST JACK
SECOND JACK
THIRD JACK
RIDGE BOARD
LAY OUT ALL RAFTERS ON BOTH SIDES OF THIS LINE FROM THIS LINE
CENTER OF END
FIRST JACK
SECOND JACK
JACKS LAID OUT BOTH WAYS FROM CENTER
THIRD JACK
LENGTH OF RIDGE BOARD

ROOF FRAMING
UNIT III

JOB SHEET #2--LAY OUT, CUT, AND ERECT RAFTERS

I. Tools and materials

   A. Tools

      1. Framing square
      2. Tape measure, 100 foot
      3. Tape measure, 12 or 16 foot
      4. Claw hammer, 16 oz or larger
      5. Electric handsaw
      6. Crosscut handsaw
      7. Rafter tables booklet

   B. Materials

      1. Rafter material
      2. Ridge board material
      3. Nails
         a. 16d box
         b. 8d box

II. Procedure

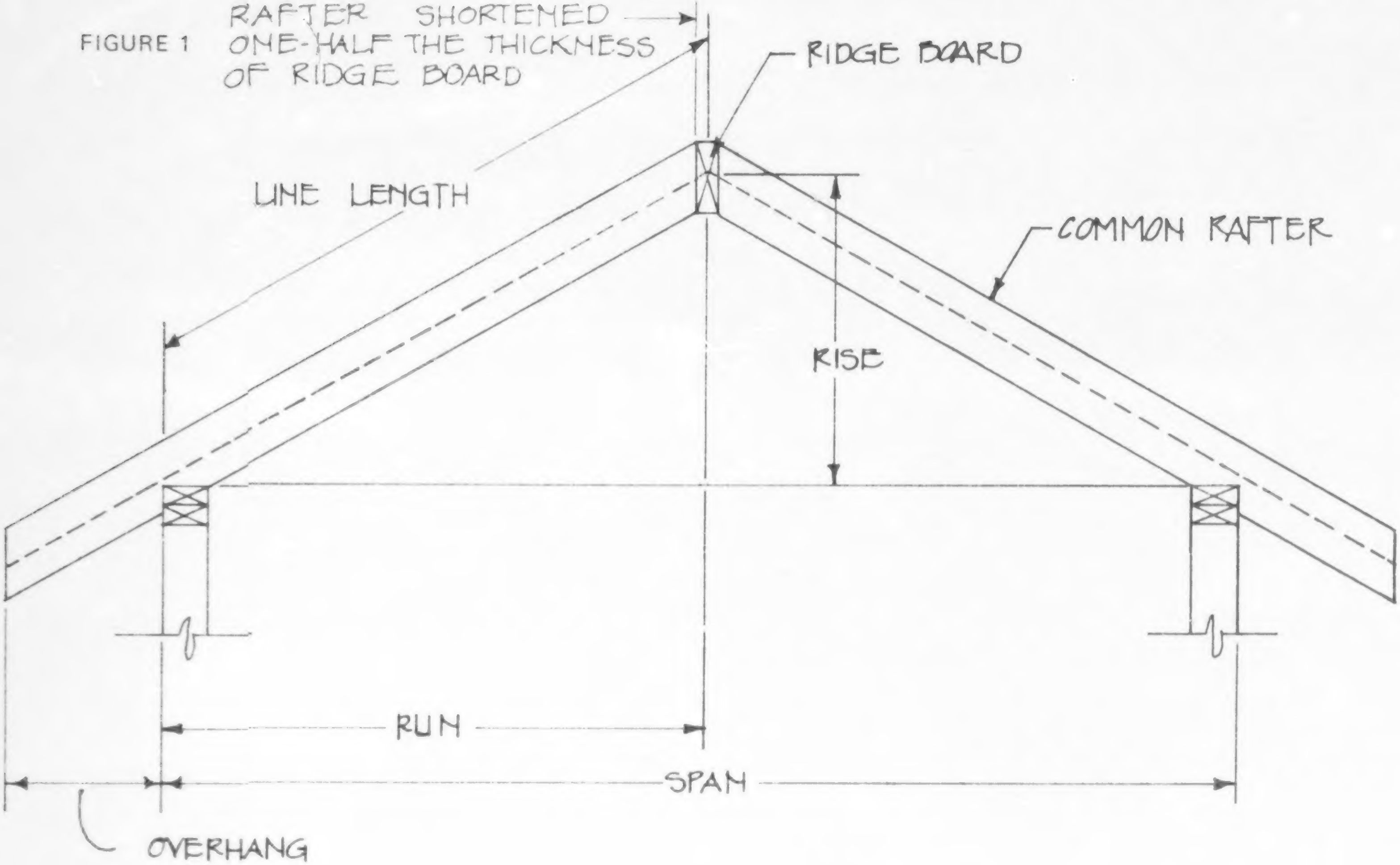
   A. Lay out and cut a pattern for each type of rafter needed

      1. Common rafter

         a. Calculate length of the rafter (Figure 1)

            (NOTE: This length is the center line length of the rafter. Use square or rafter table. See Figures 2, 3, and 4 on the following pages.)

FIGURE 1


RAFTER SHORTENED ONE-HALF THE THICKNESS OF RIDGE BOARD
RIDGE BOARD
LINE LENGTH
COMMON RAFTER
RISE
RUN
SPAN
OVERHANG

Line Length + Overhang - 1/2 Thickness of Ridge Board = True Common Rafter Length

JOB SHEET #2

FIGURE 2

JACK RAFTER

Spaced In.	Length Ft. In.
1	1
2	2⅛
3	3⅛
4	4¼
5	5¼
6	6⅜
7	7⅜
8	8⅜
9	9½
10	10½
11	11⅝
12	1 0⅝
13	1¾
14	2¾
15	3¾
16	4⅞
17	5⅞
18	7
19	8
20	9⅛
21	10⅛
22	11¼
23	2 0¼
24	1¼
25	2⅜
26	3⅜
27	4½
28	5½
29	6⅝
30	7⅝
31	8⅝
32	9¾
33	10¾
34	11⅞
35	3 0⅞
36	2
37	3
38	4
39	5⅛
40	6⅛
41	7¼
42	8¼
43	9⅜
44	10⅜
45	11⅜
46	4 0½
47	1½
48	2⅝

4 INCHES UNIT RISE PER FOOT

EXPLANATION

Common Rafter

Width of building............31'4¾"
Find length of Common Rafter.

Answer:

Under **Span**, ft. find 31' = 16' 4"
" " in. " 4¾" = 2⅛"

Total length Common Rft. 16' 6⅛"

When rafters overhang, add both overhangs to width of building. Use total span as before.

To get length of rafter by its run: doubling the run gives the span. Proceed as before.

Tables give full length. Allow for half thickness of ridge.

Spans over 50', as 60', add lengths of 50' & 10' spans together.

Hip Rafter

If common rafter span is 31'4¾", Hip rafter is 22'9¾" long. Measure length of Hip on center of top edge. If Hip is unbacked (top edge square), see Index. If edge is backed (beveled), see Index.

Allow for half thickness of ridge.

Jack Rafters

Spaced 28" apart are 2'5½" different in length. Measure length on center of top edge. Cut short equal to half thickness of hip.

CUTS FOR STEEL SQUARE.

The first figure is always the cut.

Common Rafter

Plumb 4 - 12
Level. 12 4

Hip Rafter

Plumb 4 - 17
Level 17 - 4
Side 8⅜ - 8½
Backing 4 - 17⅜
Set bevel to last named.

Jack Rafter

Plumb 4 - 12
Level. 12 4
Side.. 12⅝ - 12

Purlin Rafter Roof Sheathing

Plumb 4 - 12⅝
Cross. 12 - 12⅝

Valley Shingles

Cross. 12 - 12⅝
Set bevel on butt end.

Mitre-Box Cuts for Gable Moulds

Plumb 4 - 12
Mitre. 12⅝ - 12

Bisection of

4 - 12 3⅞ - 24

For full explanation see Index.

COMMON RAFTER

Span Ft.	Length Ft. In.	Span In.	Lgth. In.
1	. 6⅜	¼	⅛
2	1. 0⅝	½	¼
3	1. 7	¾	⅜
4	2. 1¼	1	½
5	2. 7⅝	¼	⅝
6	3. 2	½	¾
7	3. 8¼	¾	⅞
8	4. 2⅝	2	1
9	4. 8⅞	¼	⅛
10	5. 3¼	½	⅜
11	5. 9⅝	¾	½
12	6. 3⅞	3	⅝
13	6. 10¼	¼	¾
14	7. 4½	½	⅞
15	7. 10⅞	¾	2
16	8. 5¼	4	⅛
17	8. 11½	¼	¼
18	9. 5⅞	½	⅜
19	10. 0⅛	¾	½
20	10. 6½	5	⅝
21	11. 0⅞	¼	¾
22	11. 7⅛	½	⅞
23	12. 1½	¾	3
24	12. 7¾	6	⅛
25	13. 2⅛	¼	¼
26	13. 8½	½	⅜
27	14. 2¾	¾	½
28	14. 9⅛	7	¾
29	15. 3⅜	¼	⅞
30	15. 9¾	½	4
31	16. 4	¾	⅛
32	16. 10⅜	8	¼
33	17. 4¾	¼	⅜
34	17. 11	½	½
35	18. 5⅜	¾	⅝
36	18. 11⅝	9	¾
37	19. 6	¼	⅞
38	20. 0⅜	½	5
39	20. 6⅝	¾	⅛
40	21. 1	10	¼
41	21. 7¼	¼	⅜
42	22. 1⅝	½	½
43	22. 8	¾	⅝
44	23. 2¼	11	¾
45	23. 8⅝	¼	⅞
46	24. 3	½	6
47	24. 9¼	¾	¼
48	25. 3⅝	12	⅜
49	25. 9⅞		
50	26. 4¼		

HIP or VALLEY RAFTER

Span Ft.	Length Ft. In.	Span In.	Lgth. In.
1	. 8¾	¼	⅛
2	1. 5⅜	½	⅜
3	2. 2⅛	¾	½
4	2. 10⅞	1	¾
5	3. 7⅝	¼	⅞
6	4. 4¼	½	1⅛
7	5. 1	¾	¼
8	5. 9¾	2	½
9	6. 6½	¼	⅝
10	7. 3⅛	½	⅞
11	7. 11⅞	¾	2
12	8. 8⅝	3	⅛
13	9. 5⅜	¼	⅜
14	10. 2	½	½
15	10. 10¾	¾	¾
16	11. 7½	4	⅞
17	12. 4¼	¼	3⅛
18	13. 0⅞	½	¼
19	13. 9⅝	¾	½
20	14. 6⅜	5	⅝
21	15. 3⅛	¼	⅞
22	15. 11¾	½	4
23	16. 8½	¾	⅛
24	17. 5¼	6	⅜
25	18. 2	¼	½
26	18. 10⅝	½	¾
27	19. 7⅜	¾	⅞
28	20. 4⅛	7	5⅛
29	21. 0⅞	¼	¼
30	21. 9½	½	½
31	22. 6¼	¾	⅝
32	23. 3	8	¾
33	23. 11¾	¼	6
34	24. 8⅜	½	⅛
35	25. 5⅛	¾	⅜
36	26. 1⅞	9	½
37	26. 10½	¼	¾
38	27. 7¼	½	⅞
39	28. 4	¾	7⅛
40	29. 0¾	10	¼
41	29. 0⅜	¼	½
42	30. 6⅛	½	⅝
43	31. 2⅞	¾	¾
44	31. 11⅝	11	8
45	32. 8¼	¼	⅛
46	33. 5	½	⅜
47	34. 1¾	¾	½
48	34. 10½	12	¾
49	35. 7⅛		
50	36. 3⅞		

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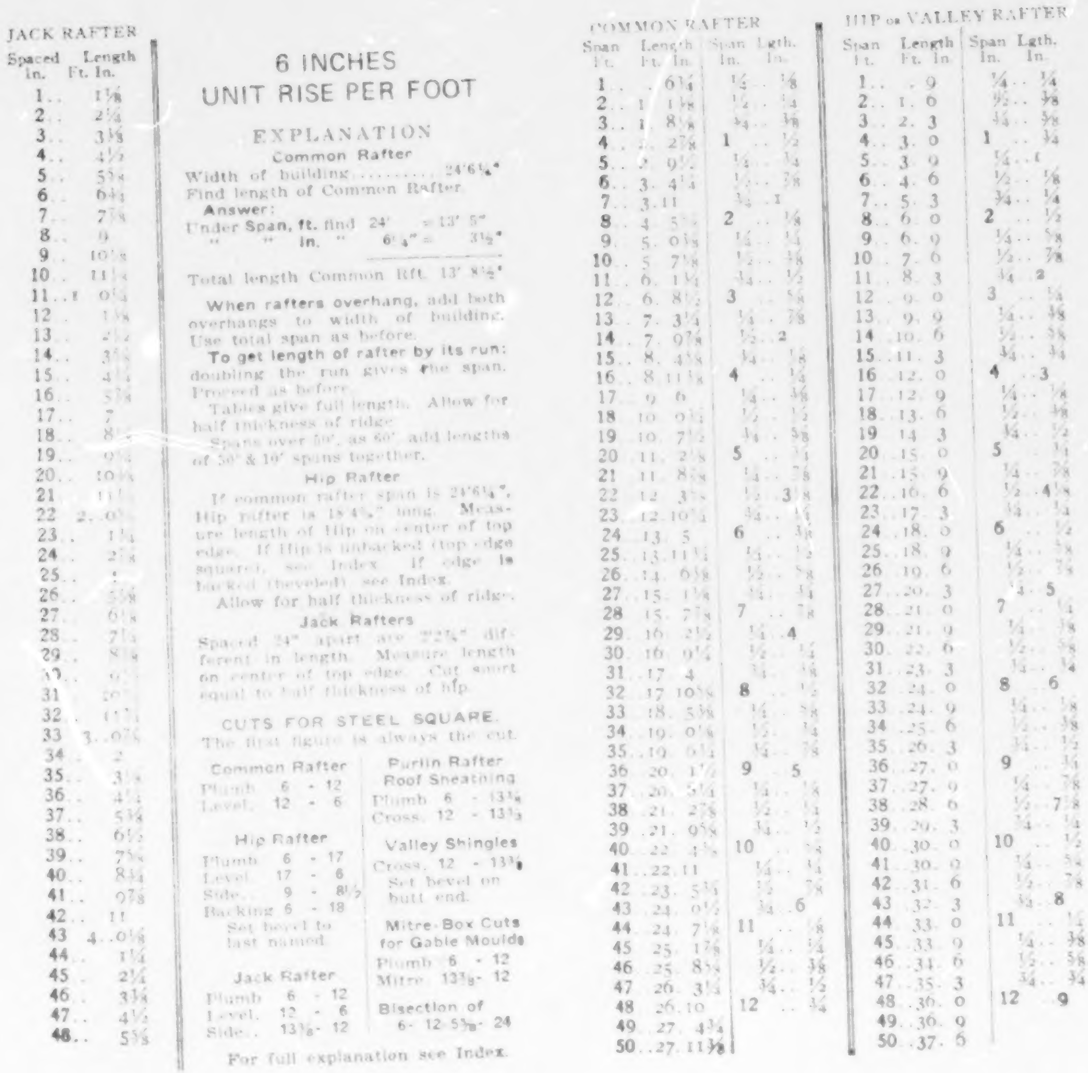
JOB SHEET #2

FIGURE 3



JACK RAFTER

Spaced In.	Length Ft. In.
1	1⅛
2	2¼
3	3⅜
4	4½
5	5⅝
6	6¾
7	7⅞
8	9
9	10⅛
10	11⅛
11	1 0¼
12	1⅜
13	2½
14	3⅝
15	4¾
16	5⅞
17	7
18	8⅛
19	9¼
20	10⅜
21	11½
22	2 0⅝
23	1¾
24	2⅞
25	[illegible]
26	5⅛
27	6¼
28	7⅜
29	8½
30	9½
31	10⅝
32	11¾
33	3 0⅞
34	2
35	3⅛
36	4¼
37	5⅜
38	6½
39	7⅝
40	8¾
41	9⅞
42	11
43	4 0⅛
44	1¼
45	2¼
46	3⅜
47	4½
48	5⅝

6 INCHES UNIT RISE PER FOOT

EXPLANATION

Common Rafter

Width of building .... 24'6¼"
Find length of Common Rafter.
Answer:
Under **Span, ft.** find 24' = 13' 5"
" " **In.** " 6¼" = 3½"

Total length Common Rft. 13' 8½"

When rafters overhang, add both overhangs to width of building. Use total span as before.

To get length of rafter by its run: doubling the run gives the span. Proceed as before.

Tables give full length. Allow for half thickness of ridge.

Spans over 50', as 60', add lengths of 50' & 10' spans together.

Hip Rafter

If common rafter span is 24'6¼", Hip rafter is 18'4⅝" long. Measure length of Hip on center of top edge. If Hip is unbacked (top edge squared), see Index. If edge is backed (beveled), see Index.

Allow for half thickness of ridge.

Jack Rafters

Spaced 24" apart are 2'2⅞" different in length. Measure length on center of top edge. Cut short equal to half thickness of hip.

CUTS FOR STEEL SQUARE.

The first figure is always the cut.

Common Rafter
Plumb 6 - 12
Level. 12 - 6

Hip Rafter
Plumb 6 - 17
Level 17 - 6
Side.. 9 - 8½
Backing 6 - 18
Set bevel to last named.

Jack Rafter
Plumb 6 - 12
Level. 12 - 6
Side.. 13⅜ - 12

Purlin Rafter Roof Sheathing
Plumb 6 - 13⅜
Cross. 12 - 13⅜

Valley Shingles
Cross. 12 - 13⅜
Set bevel on butt end.

Mitre-Box Cuts for Gable Moulds
Plumb 6 - 12
Mitre 13⅜ - 12

Bisection of
6 - 12 5⅝ - 24

For full explanation see Index.

COMMON RAFTER

Span Ft.	Length Ft. In.	Span In.	Lgth. In.
1	6¾	¼	⅛
2	1 1⅜	½	¼
3	1 8⅛	¾	⅜
4	2 2⅞	1	½
5	2 9½	¼	¾
6	3 4¼	½	⅞
7	3 11	¾	1
8	4 5⅝	2	⅛
9	5 0⅜	¼	¼
10	5 7⅛	½	⅜
11	6 1¾	¾	½
12	6 8½	3	⅝
13	7 3¼	¼	⅞
14	7 9⅞	½	2
15	8 4⅝	¾	⅛
16	8 11⅜	4	¼
17	9 6	¼	⅜
18	10 0¾	½	½
19	10 7½	¾	⅝
20	11 2⅛	5	¾
21	11 8⅞	¼	⅞
22	12 3⅝	½	3⅛
23	12 10¼	¾	¼
24	13 5	6	⅜
25	13 11¾	¼	½
26	14 6⅜	½	⅝
27	15 1⅛	¾	¾
28	15 7⅞	7	⅞
29	16 2½	¼	4
30	16 9¼	½	¼
31	17 4	¾	⅜
32	17 10⅝	8	½
33	18 5⅜	¼	⅝
34	19 0⅛	½	¾
35	19 6¾	¾	⅞
36	20 1½	9	5
37	20 8¼	¼	⅛
38	21 2⅞	½	¼
39	21 9⅝	¾	½
40	22 4⅜	10	⅝
41	22 11	¼	¾
42	23 5¾	½	⅞
43	24 0½	¾	6
44	24 7⅛	11	⅛
45	25 1⅞	¼	¼
46	25 8⅝	½	⅜
47	26 3¼	¾	½
48	26 10	12	¾
49	27 4¾		
50	27 11⅜		

HIP or VALLEY RAFTER

Span Ft.	Length Ft. In.	Span In.	Lgth. In.
1	9	¼	¼
2	1 6	½	⅜
3	2 3	¾	⅝
4	3 0	1	¾
5	3 9	¼	1
6	4 6	½	⅛
7	5 3	¾	¼
8	6 0	2	½
9	6 9	¼	⅝
10	7 6	½	⅞
11	8 3	¾	2
12	9 0	3	¼
13	9 9	¼	⅜
14	10 6	½	⅝
15	11 3	¾	¾
16	12 0	4	3
17	12 9	¼	⅛
18	13 6	½	⅜
19	14 3	¾	½
20	15 0	5	¾
21	15 9	¼	⅞
22	16 6	½	4⅛
23	17 3	¾	¼
24	18 0	6	½
25	18 9	¼	⅝
26	19 6	½	⅞
27	20 3	¾	5
28	21 0	7	¼
29	21 9	¼	⅜
30	22 6	½	⅝
31	23 3	¾	¾
32	24 0	8	6
33	24 9	¼	⅛
34	25 6	½	⅜
35	26 3	¾	½
36	27 0	9	¾
37	27 9	¼	⅞
38	28 6	½	7⅛
39	29 3	¾	¼
40	30 0	10	½
41	30 9	¼	⅝
42	31 6	½	⅞
43	32 3	¾	8
44	33 0	11	¼
45	33 9	¼	⅜
46	34 6	½	⅝
47	35 3	¾	¾
48	36 0	12	9
49	36 9		
50	37 6		

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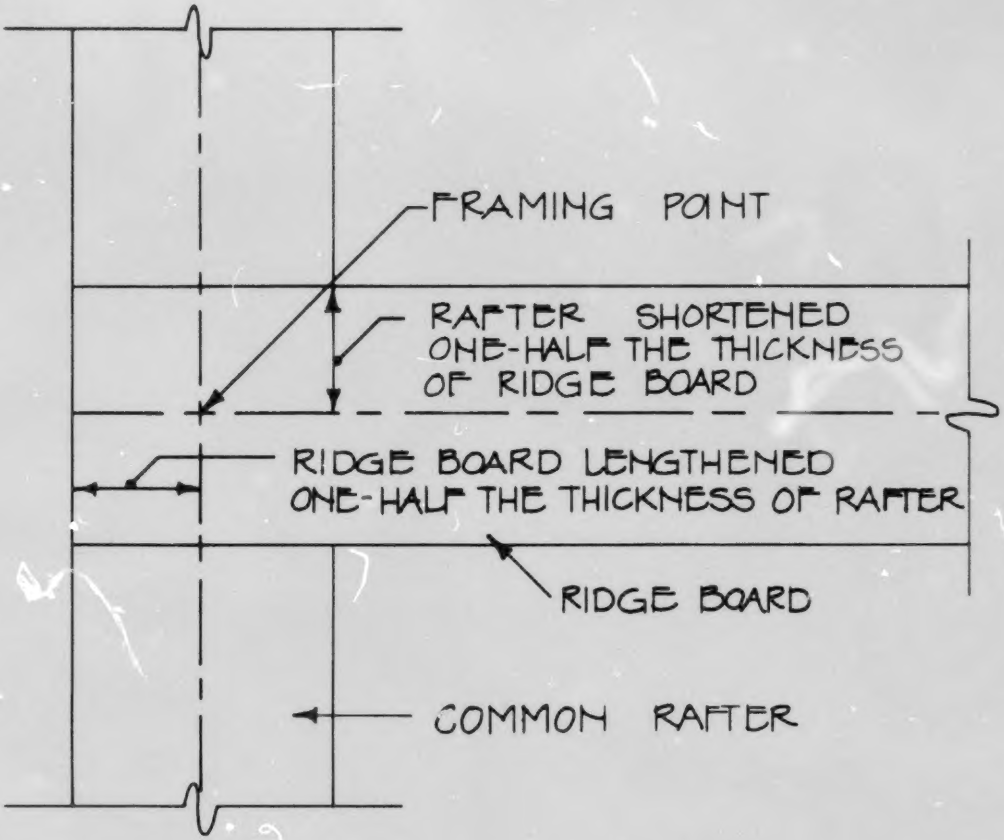
JOB SHEET #2

b. Shorten the length of the rafter by one-half the thickness of the ridge board (Figure 4)

FIGURE 4


FRAMING POINT
RAFTER SHORTENED ONE-HALF THE THICKNESS OF RIDGE BOARD
RIDGE BOARD LENGTHENED ONE-HALF THE THICKNESS OF RAFTER
RIDGE BOARD
COMMON RAFTER

c. Lay a 2 x 6, sufficient in length for a common rafter including overhang, across two saw horses

d. Mark the top end or plumb cut first

1) Determine the crown edge of the rafter

2) Make sure the toe of the plumb cut is on the crown edge

3) Place the framing square across the face of the rafter near one end with the blade running lengthwise with the rafter and the tongue running across the face of the rafter

4) Locate the inches of rise per foot of run on the tongue

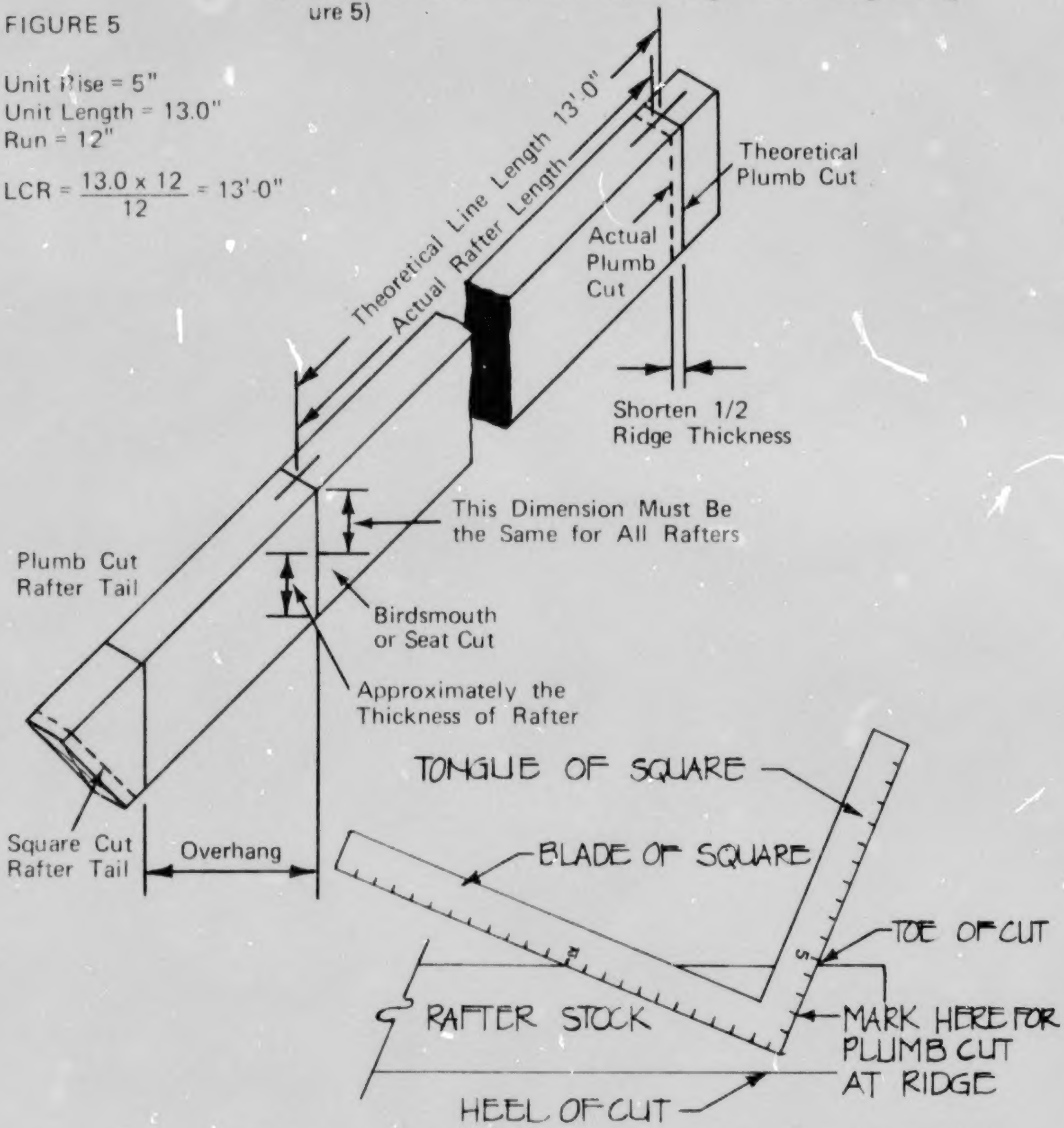
JOB SHEET #2

5) Locate the inches of run on the blade of the square

(NOTE: The run will always be twelve inches for common rafters.)

6) Mark the rafter on the outside edge of the tongue (Figure 5)

FIGURE 5



Unit Rise = 5"
Unit Length = 13.0"
Run = 12"

$LCR = \frac{13.0 \times 12}{12} = 13'\text{-}0''$

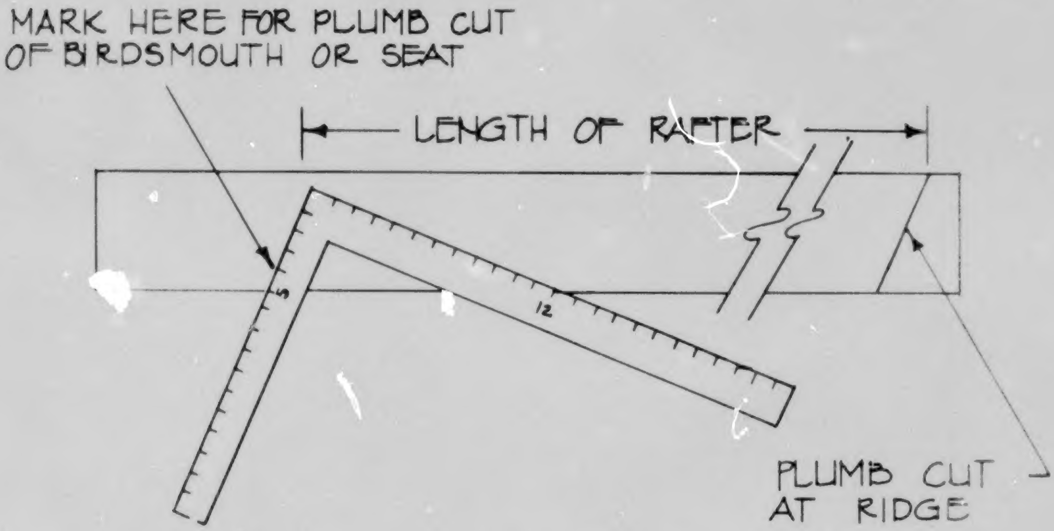
Theoretical Line Length 13'-0"
Actual Rafter Length
Theoretical Plumb Cut
Actual Plumb Cut
Shorten 1/2 Ridge Thickness
This Dimension Must Be the Same for All Rafters
Plumb Cut Rafter Tail
Birdsmouth or Seat Cut
Approximately the Thickness of Rafter
Square Cut Rafter Tail
Overhang
TONGUE OF SQUARE
BLADE OF SQUARE
TOE OF CUT
5
12
RAFTER STOCK
MARK HERE FOR PLUMB CUT AT RIDGE
HEEL OF CUT

e. Measure the length of the rafter on the top edge from the toe of the plumb cut

JOB SHEET #2

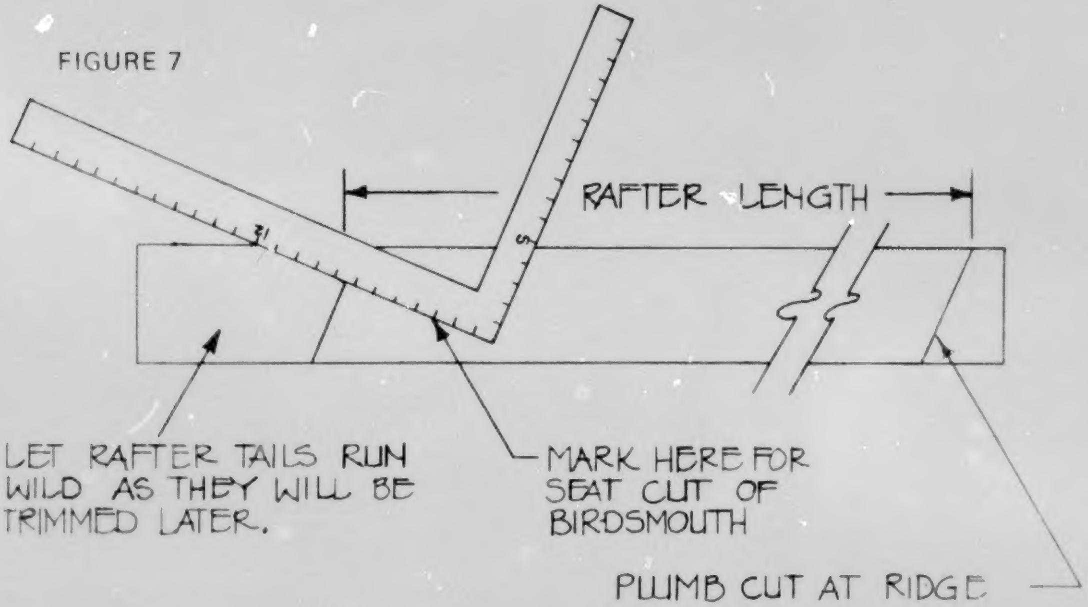
f. Place the framing square in position to mark the plumb cut for the birdsmouth and mark (Figure 6)

FIGURE 6


MARK HERE FOR PLUMB CUT
OF BIRDSMOUTH OR SEAT
LENGTH OF RAFTER
5
12
PLUMB CUT
AT RIDGE

g. Place the framing square in position to mark the seat cut for the birdsmouth and mark (Figure 7)

FIGURE 7


RAFTER LENGTH
12
5
LET RAFTER TAILS RUN
WILD AS THEY WILL BE
TRIMMED LATER.
MARK HERE FOR
SEAT CUT OF
BIRDSMOUTH
PLUMB CUT AT RIDGE

(NOTE: Birdsmouth cut should not exceed more than one-third of material.)

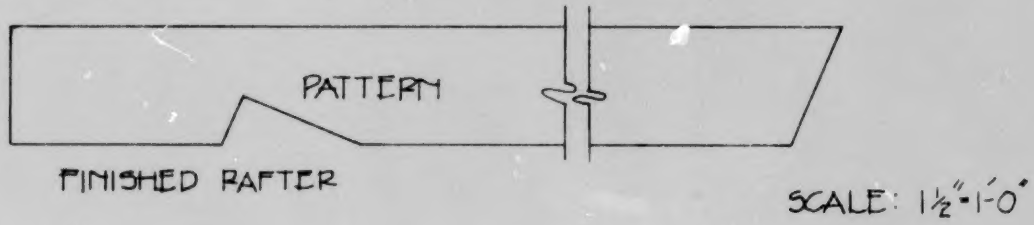
JOB SHEET #2

h. Cut the rafter on the lines marked using the electric handsaw (Figure 8)

(CAUTION: Cut only part of the way on the birdsmouth with the electric saw and finish the cut with a handsaw. The finished rafter should look like the one in Figure 8.)

(NOTE: Care must be taken to get a very accurate cut on the first rafter as it will be used as a pattern for the remaining common rafters. Write PATTERN on both sides.)

FIGURE 8



(NOTE: Birdsmouth cut should not exceed more than one-third of material.)

2. Hip rafter

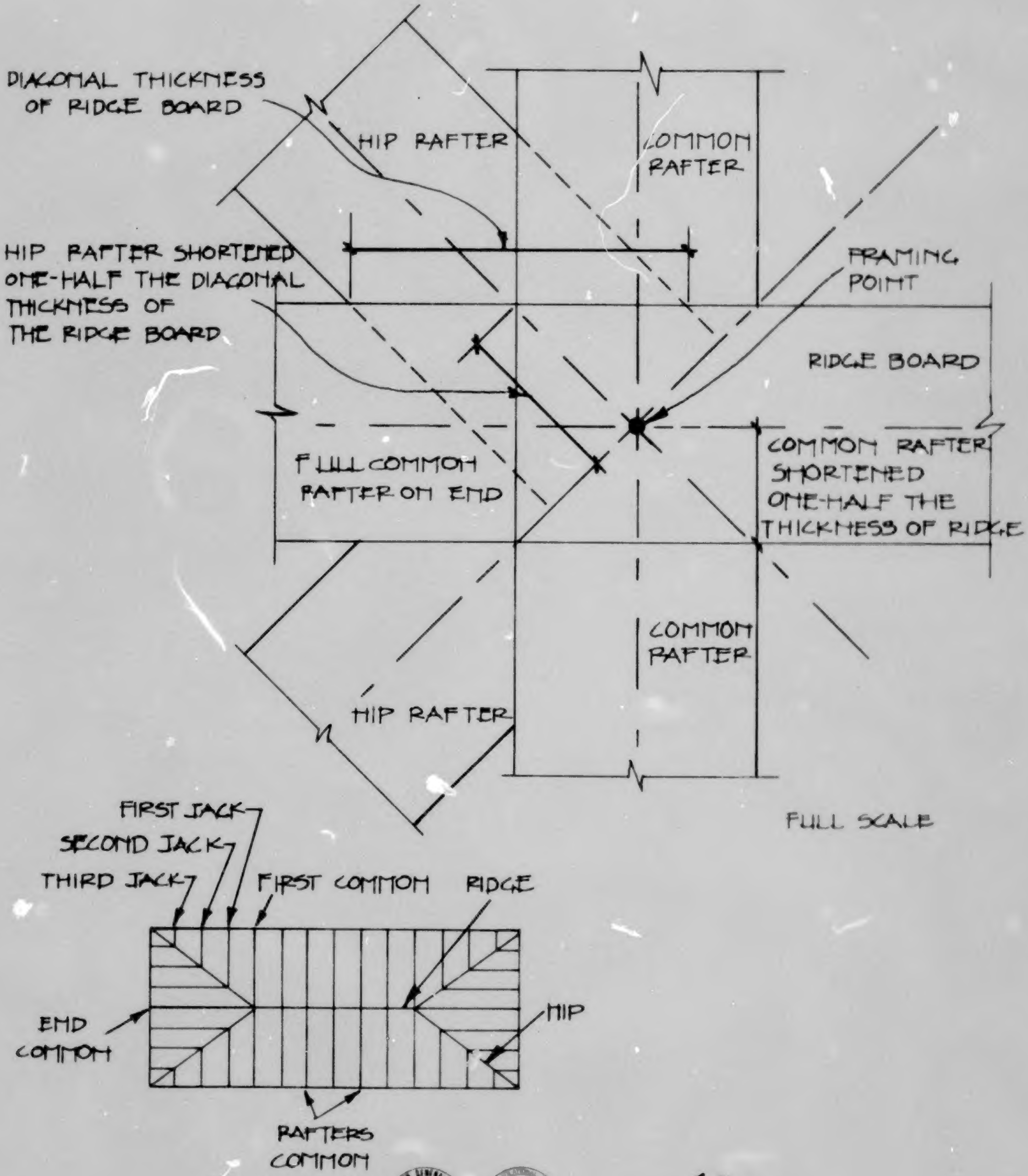
   a. Check length of the rafters

   (NOTE: This can be determined by measurement. This length is the center line length of the rafter.)

JOB SHEET #2

b. Shorten the length of the rafter to allow for the ridge board by one-half the diagonal thickness of the rafter (Figure 9)

FIGURE 9

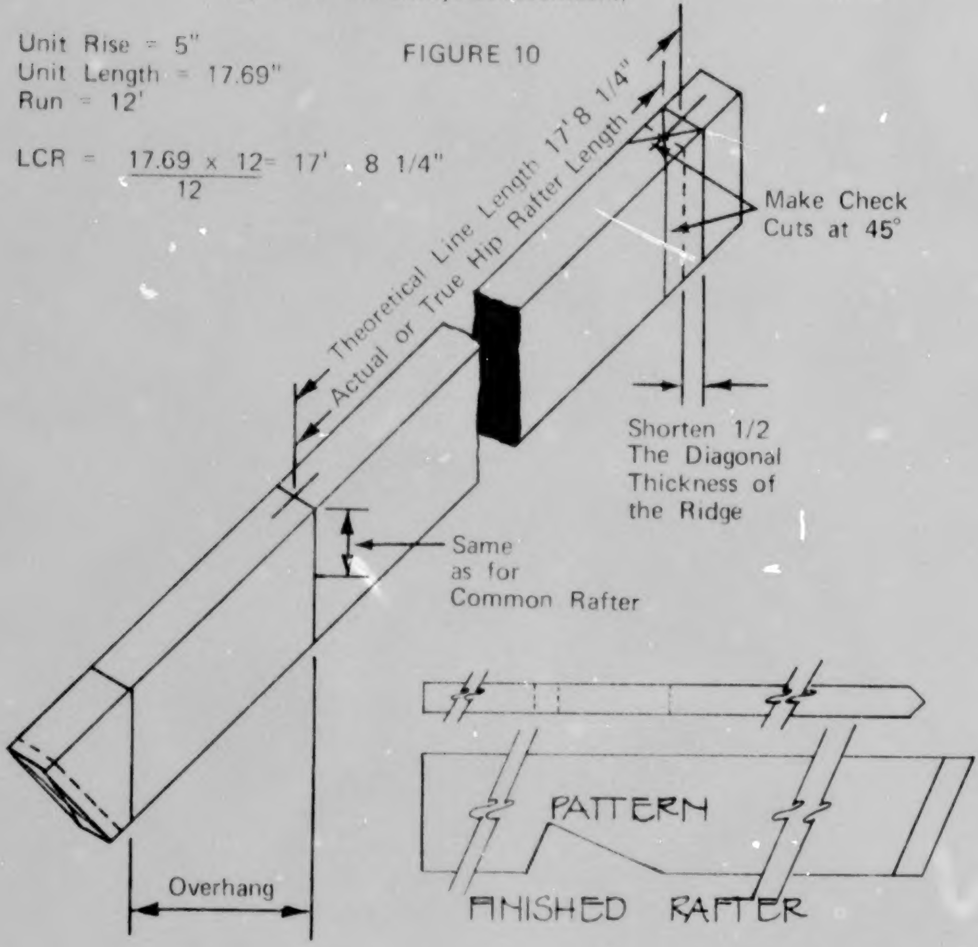

DIAGONAL THICKNESS OF RIDGE BOARD
HIP RAFTER
COMMON RAFTER
HIP RAFTER SHORTENED ONE-HALF THE DIAGONAL THICKNESS OF THE RIDGE BOARD
FRAMING POINT
RIDGE BOARD
FULL COMMON RAFTER ON END
COMMON RAFTER SHORTENED ONE-HALF THE THICKNESS OF RIDGE
COMMON RAFTER
HIP RAFTER
FULL SCALE
FIRST JACK
SECOND JACK
THIRD JACK
FIRST COMMON
RIDGE
END COMMON
HIP
RAFTERS COMMON

JOB SHEET #2

c. Lay a 2 x 6, sufficient in length for a hip rafter including the overhang, across two sawhorses and lay out and cut the same as for a common rafter (Figure 10)

(NOTE: The inches run on the blade of the framing square for a hip rafter will always be seventeen.)

FIGURE 10



Unit Rise = 5"
Unit Length = 17.69"
Run = 12'

$$\text{LCR} = \frac{17.69 \times 12}{12} = 17' \; 8\ 1/4"$$

Theoretical Line Length 17' 8 1/4"
Actual or True Hip Rafter Length
Make Check Cuts at 45°
Shorten 1/2 The Diagonal Thickness of the Ridge
Same as for Common Rafter
Overhang
PATTERN
FINISHED RAFTER

3. Hip jack rafters on two-foot centers

   a. Determine the length of the first jack

      (NOTE: Remember that the figure read from the framing square is the difference in length of jack rafters from the common rafter.)

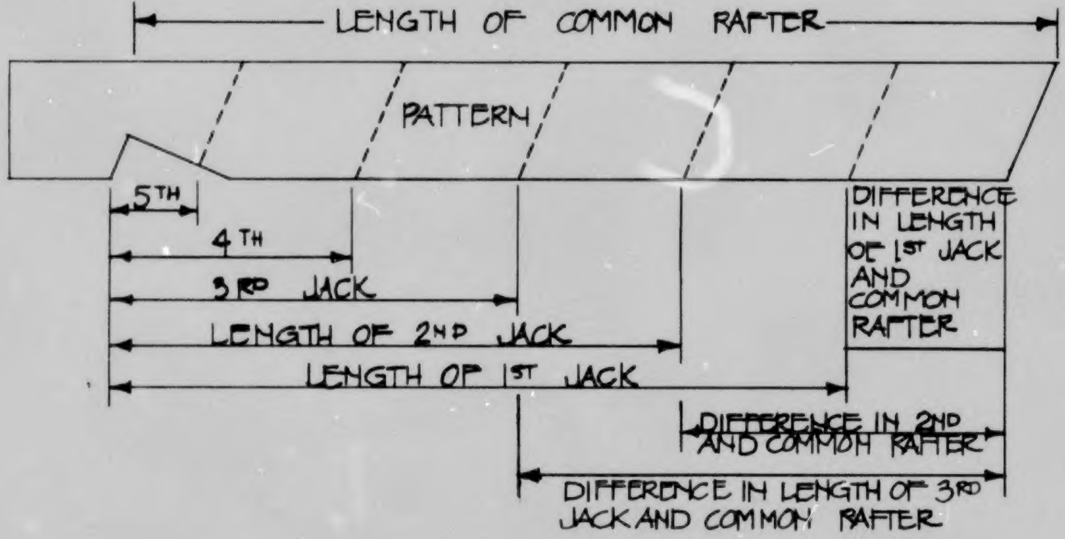
   b. Use the pattern for common rafters to mark the birdsmouth

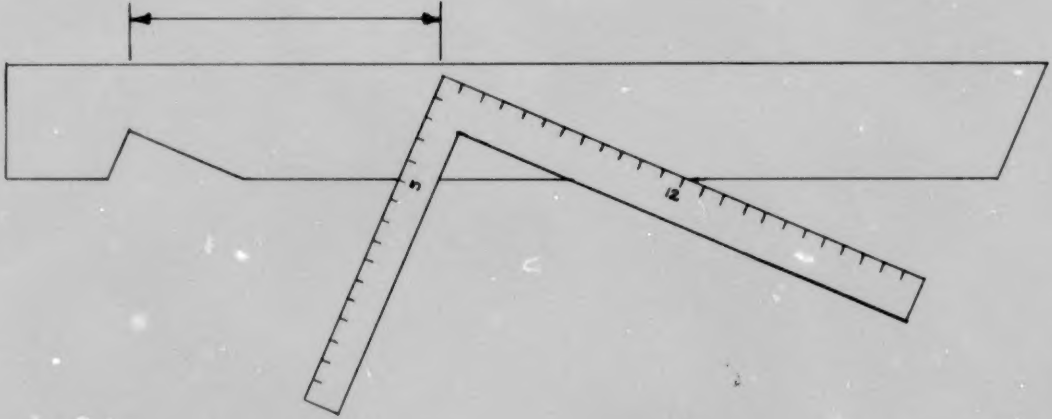
      (NOTE: Drop the hip to align with common rafters.)

JOB SHEET #2

c. Measure the length of the first jack rafter from the plumb cut of the birdsmouth (Figure 11)

FIGURE 11


LENGTH OF COMMON RAFTER
PATTERN
5TH
4 TH
3RD JACK
LENGTH OF 2ND JACK
LENGTH OF 1ST JACK
DIFFERENCE IN LENGTH OF 1ST JACK AND COMMON RAFTER
DIFFERENCE IN 2ND AND COMMON RAFTER
DIFFERENCE IN LENGTH OF 3RD JACK AND COMMON RAFTER

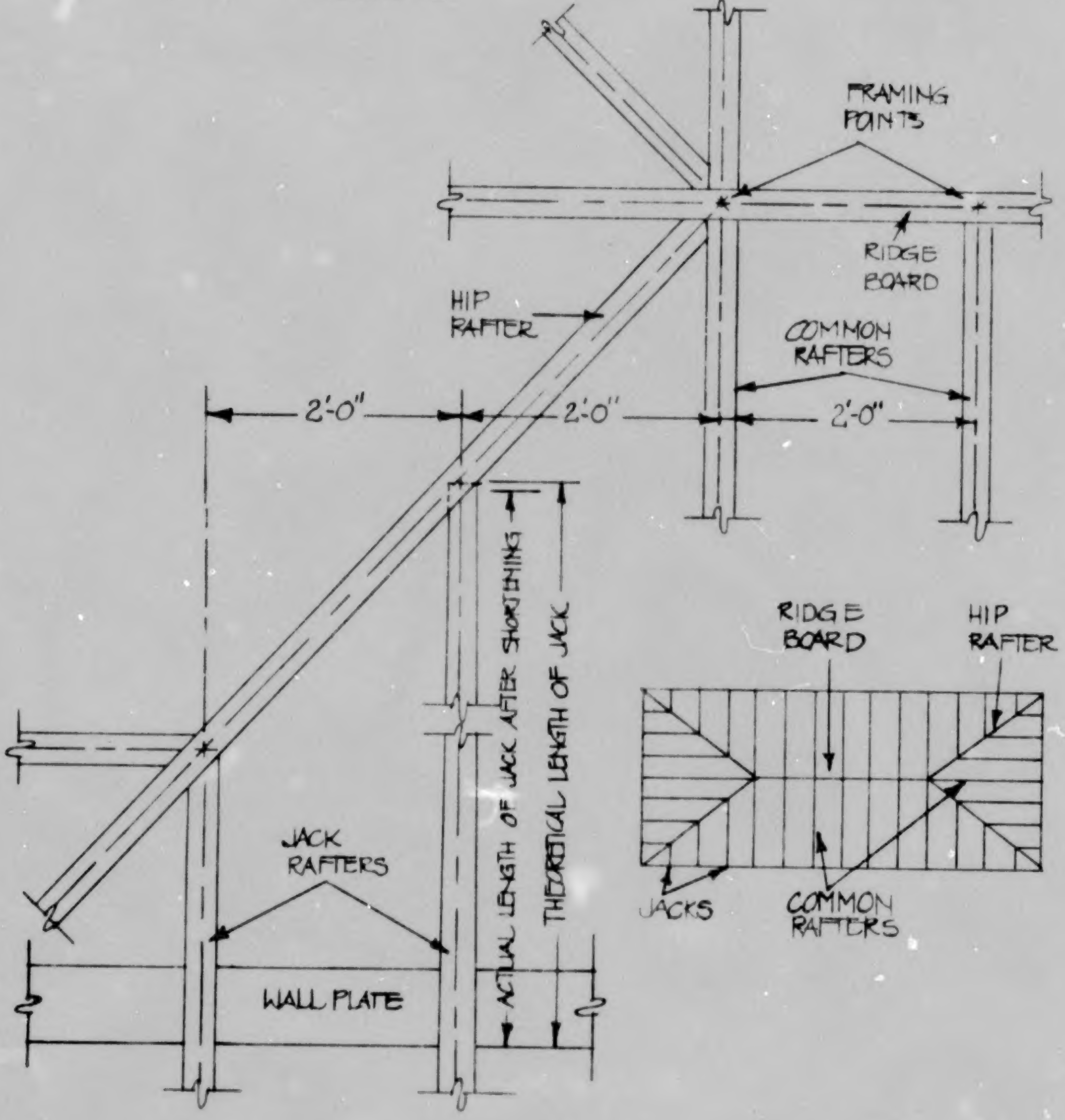


(NOTE: Remember that this is the theoretical length of the jack rafter and it must be shortened one-half the diagonal thickness of the rafter.)

JOB SHEET #2

d. Shorten the rafter (Figure 12)

FIGURE 12

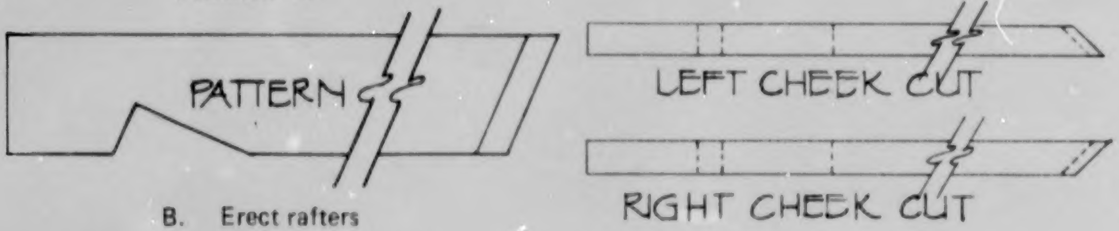

FRAMING POINTS
RIDGE BOARD
HIP RAFTER
COMMON RAFTERS
2'-0"
2'-0"
2'-0"
ACTUAL LENGTH OF JACK AFTER SHORTENING
THEORETICAL LENGTH OF JACK
JACK RAFTERS
WALL PLATE
RIDGE BOARD
HIP RAFTER
JACKS
COMMON RAFTERS

JOB SHEET #2

e. Lay out and cut all jacks (Figure 13)

(NOTE: For every jack with a cheek cut on the left, there must be one of equal length with a cheek cut on the right.)

FIGURE 13


PATTERN
LEFT CHEEK CUT
RIGHT CHEEK CUT

B. Erect rafters

1. Gable roof

(CAUTION: Place boards across ceiling joist to walk on to keep from falling through the joist.)

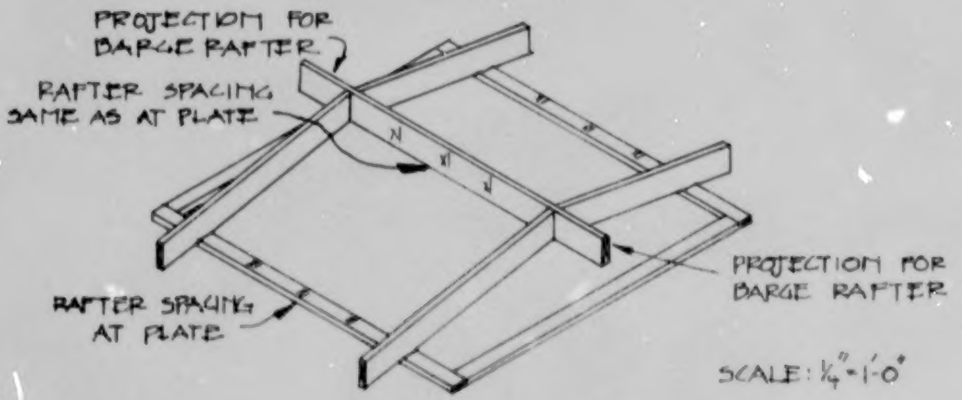
a. Lean all of the rafters against the sides of the house at each rafter location with the plumb cut up

b. Erect and plumb rafter at second location, nailing with 16d box nails through the ridge into the rafter (Figure 14)

c. Nail rafter on opposite side

(CAUTION: Be sure that the top of all rafters are flush with the top of the ridge board and inside the marks on the ridge.)

FIGURE 14


PROJECTION FOR BARGE RAFTER
RAFTER SPACING SAME AS AT PLATE
PROJECTION FOR BARGE RAFTER
RAFTER SPACING AT PLATE
SCALE: 1/4" = 1'-0"

JOB SHEET #2

d. Toe nail the seat of the birdsmouth cut to the plate using 16d box nails

(CAUTION: Be sure that the plumb cut of the birdsmouth is snugged up to the outside of the plate. Have a helper hold the ridge up until the nailing is accomplished.)

e. Erect the remaining rafters following the same procedures used in erecting the end rafters

(NOTE: Keep the ridge straight. To accomplish this, erect opposing pairs and stretch a string along the top of the center of the ridge as a guide.)

f. Erect end rafters; plumb and brace

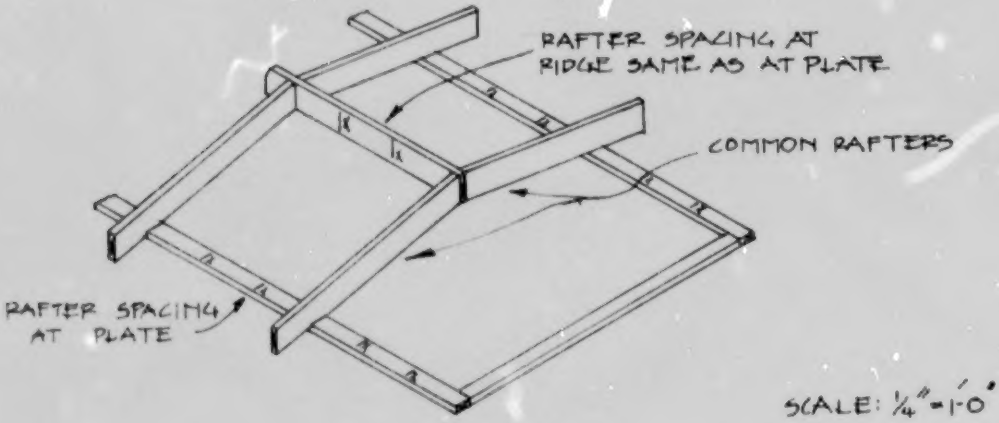
2. Hip roof

(CAUTION: Place boards across ceiling joist to walk on.)

a. Lean all of the rafters against the sides of the house at each rafter location with the plumb cut up

b. Erect the last common rafters on the sides first (Figure 15)

FIGURE 15



1) Nail through ridge into end of rafters with 16d box nails

(CAUTION: Be sure that the tops of all rafters are flush with the top of the ridge board.)

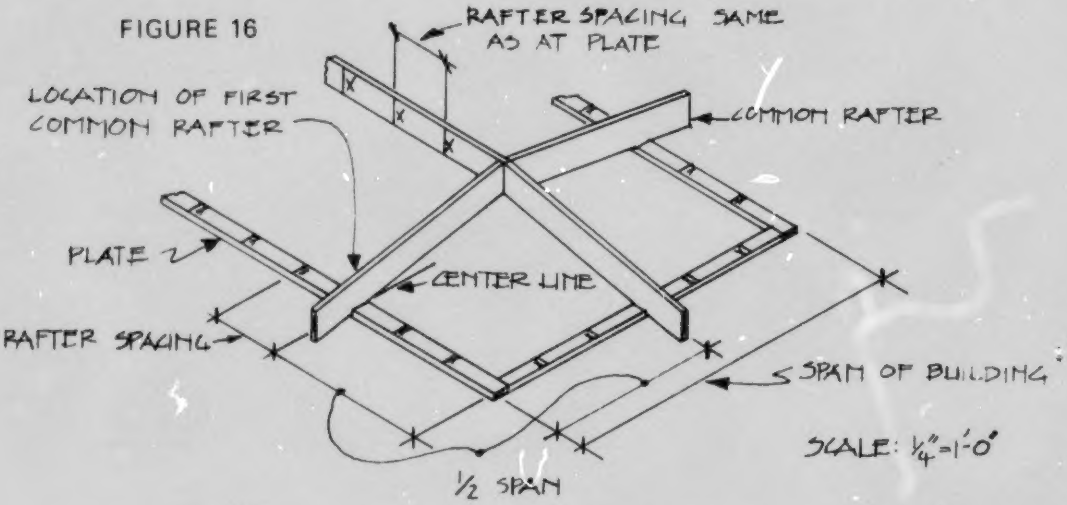
JOB SHEET #2

2) Toe nail the seat of the birdsmouth cut to the plate with 16d box nails

(CAUTION: Be sure that the plumb cut of the birdsmouth is snugged up to the outside of the plate.)

c. Erect the end common rafters next, toe nailing into the ridge and into the plate (Figure 16)

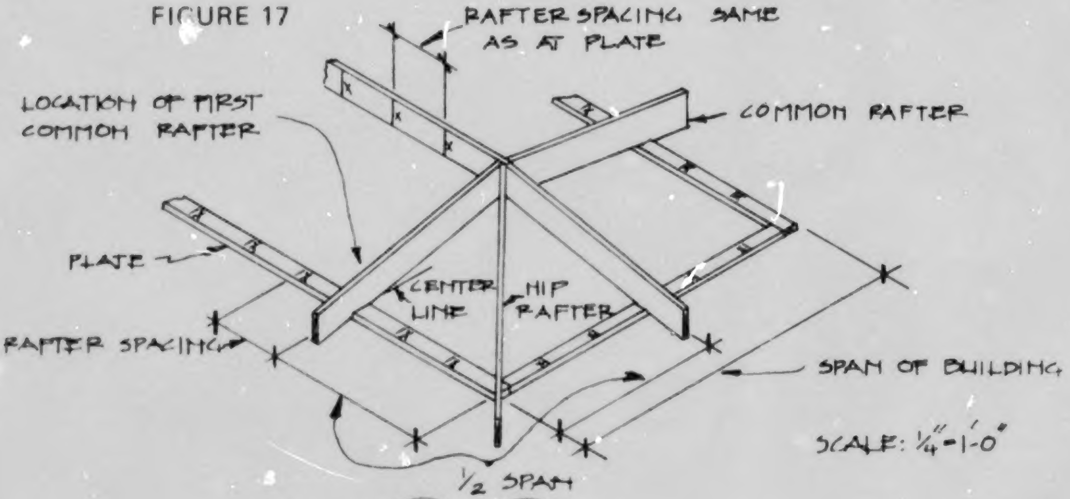
FIGURE 16


RAFTER SPACING SAME AS AT PLATE
LOCATION OF FIRST COMMON RAFTER
COMMON RAFTER
PLATE
CENTER LINE
RAFTER SPACING
SPAN OF BUILDING
SCALE: ¼"=1'-0"
½ SPAN

(CAUTION: Be sure that the top of the rafters are flush with the top of the ridge board and that the plumb cut of the birdsmouth is snug to the outside of the plate.)

d. Erect the hip rafters following the same procedure (Figure 17)

FIGURE 17


RAFTER SPACING SAME AS AT PLATE
LOCATION OF FIRST COMMON RAFTER
COMMON RAFTER
PLATE
CENTER LINE
HIP RAFTER
RAFTER SPACING
SPAN OF BUILDING
SCALE: ¼"=1'-0"
½ SPAN

JOB SHEET #2

e. Erect hip jack rafters

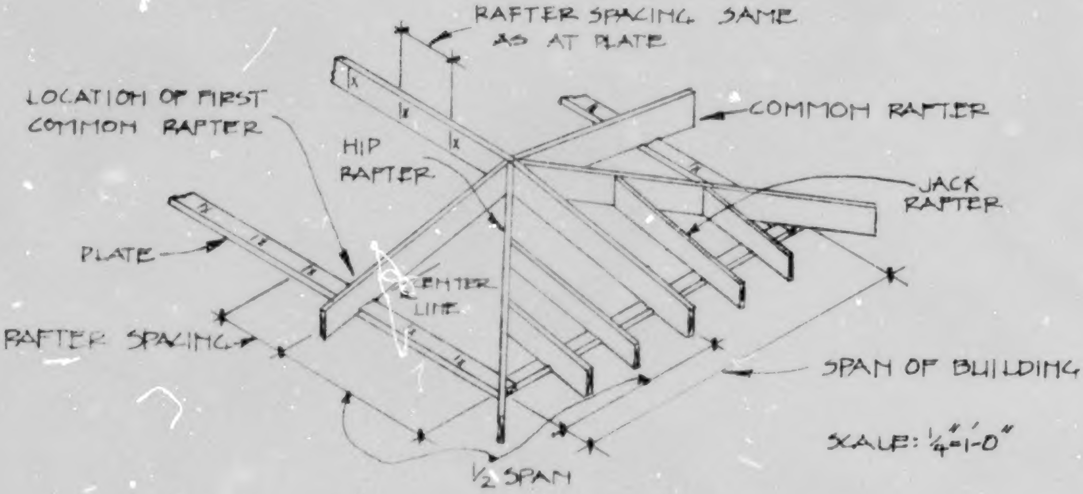
1) Proceed from the longest to the shortest

2) Do both sides of the hip at the same time (Figure 18)

(NOTE: Nail through the common rafter into the hip rafter at the cheek with 8d box nails.)

(CAUTION: Be sure to keep the top of the hip in a straight line from top to bottom.)

FIGURE 18


RAFTER SPACING SAME AS AT PLATE
LOCATION OF FIRST COMMON RAFTER
HIP RAFTER
COMMON RAFTER
JACK RAFTER
PLATE
CENTER LINE
RAFTER SPACING
SPAN OF BUILDING
SCALE: 1/4"=1'-0"
1/2 SPAN

(NOTE: Stretch a string from the top of the hip to the bottom to aid in keeping the hip line straight.)

f. Erect the remaining rafters following all of the procedures listed

C. Trim rafter tails

1. Determine the amount of overhang desired

2. Chalk a line on the top of all rafters to locate the cutting line

3. Mark the side of each rafter with the framing square for a square cut end

JOB SHEET #2

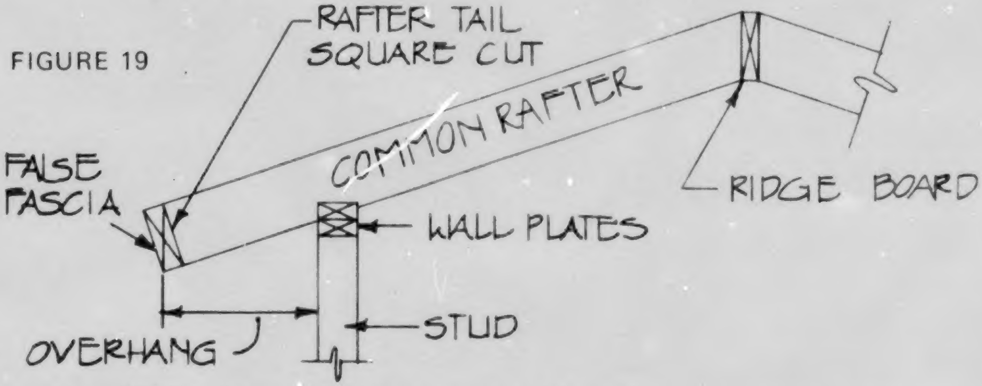
4. Cut off tails with electric handsaw

   (NOTE: Erect a platform using sawhorses and planks to walk on while cutting.)

   (CAUTION: Assume a comfortable and safe position before starting each cut.)

D. Nail the false fascia to the ends of all rafters around the perimeter of the house allowing ends on gable roof to extend far enough for barge rafter (Figure 19)

FIGURE 19

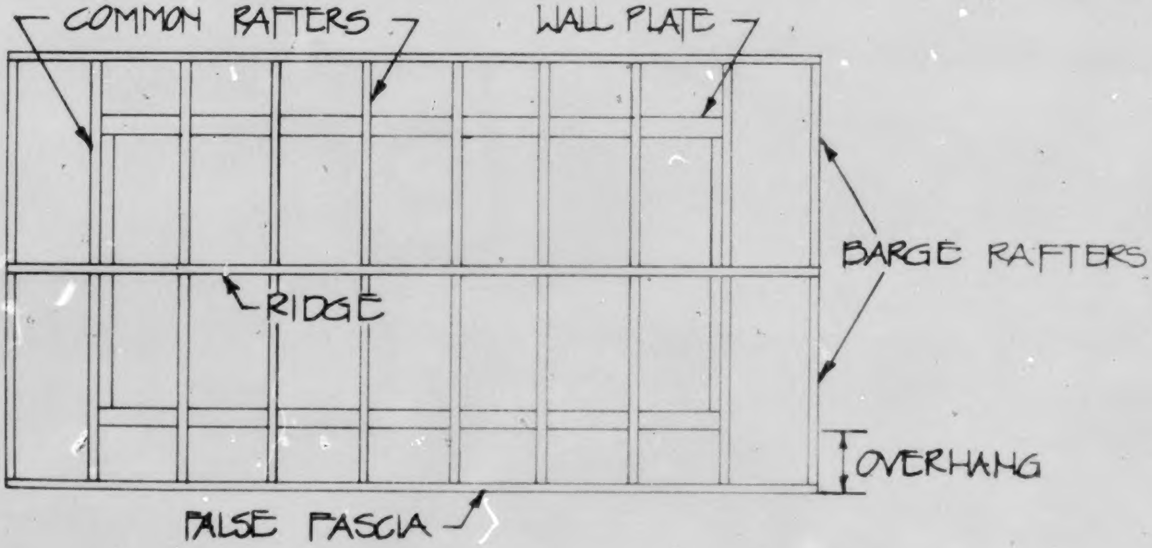

RAFTER TAIL
SQUARE CUT
COMMON RAFTER
FALSE
FASCIA
WALL PLATES
RIDGE BOARD
STUD
OVERHANG

(NOTE: When projection exceeds 16", lookouts are needed, placed every two feet. All splices for false fascia must be on rafter ends.)

E. Install barge rafters on gable roof (Figure 20)

(NOTE: Barge rafters have no birdsmouth cut.)

FIGURE 20


COMMON RAFTERS
WALL PLATE
BARGE RAFTERS
RIDGE
OVERHANG
FALSE FASCIA

ROOF FRAMING
UNIT III

JOB SHEET #3--APPLY ROOF SHEATHING

I. Tools and materials

A. Tools

1. Electric handsaw
2. Claw hammer, 16 oz or larger
3. Steel tape, 12 or 16 foot
4. Chalk line and reel

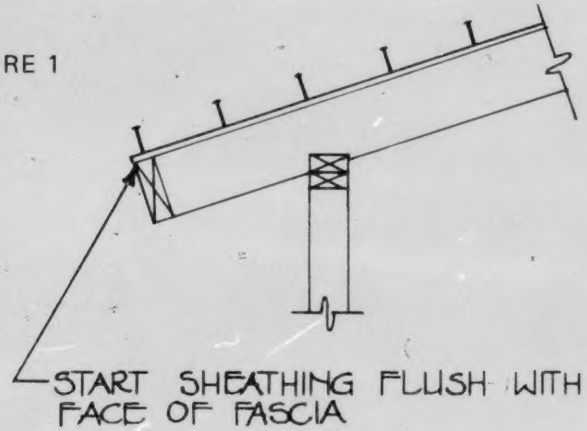
B. Materials

1. See specifications for sheathing material to use
2. Nails as specified for sheathing

II. Procedure

A. Start first sheathing board flush with the face of the false fascia and flush with the face of the barge rafter (Figure 1)

FIGURE 1



B. Allow sheathing to run wild over the hip on a hip roof, chalk a line, and cut with electric handsaw

C. Tack all boards in place, chalk a line on the center of each rafter, and finish nailing

(NOTE: All splices must be made on a rafter with staggered joints.)

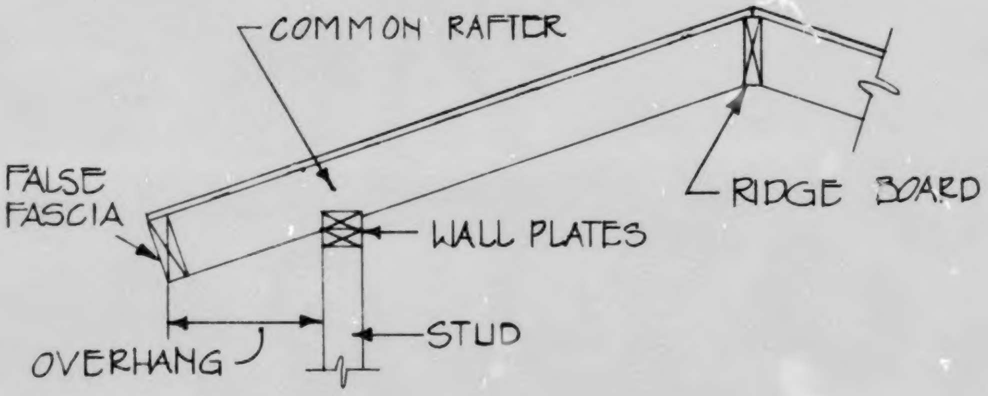
JOB SHEET #3

D. Finish the ridge

1. Run the first side to the center of the ridge

2. Run the opposite side to the center of the ridge (Figure 2)

FIGURE 2


COMMON RAFTER
FALSE FASCIA
WALL PLATES
RIDGE BOARD
STUD
OVERHANG

ROOF FRAMING
UNIT III

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____ a. Rafter extending from the double plate at the corner of the structure to the ridge, forming the angle for a hip roof

_____ b. Vertical window in a roof

_____ c. Horizontal tie beam connecting two opposite rafters up near the ridge to hold them together at the ridge

_____ d. Horizontal timbers supporting the common rafters in roofs

_____ e. Short rafter which fits between the plate and the hip or valley rafter or between the ridge and hip or valley rafter

_____ f. Incline or pitch of a roof expressed in terms of inches per one foot of run

_____ g. Angle or degree of slope of a roof

_____ h. One of a series of rafters extending from the double plate to the ridge

_____ i. Exposed rafter at the end of a gable roof; sometimes called a *verge rafter*

_____ j. Panel or bracket of either wood or metal attached to the corners at intersections of a frame to add strength and stiffness

_____ k. Cut at right angles to the seat cut of the birdsmouth; cut of the rafter at the ridge

_____ l. Horizontal distance that underlies the roof from outside of one exterior wall to the outside of opposite exterior wall

_____ m. Horizontal member or timber at the top of the roof to which the upper end of the rafters are nailed

1. Collar beam
2. Common rafter
3. Dormer
4. Gusset
5. Hip rafter
6. Jack rafter
7. Pitch
8. Purlin
9. Rise
10. Barge rafter
11. Ridge board
12. Birdsmouth
13. Run
14. Seat cut
15. Span
16. Valley rafter
17. Plumb cut

______n. Cut at the lower end of a rafter; the part of the birdsmouth that rests on the plate

______o. Horizontal distance that underlies the slope of the roof from a wall to the ridge, usually one-half of the span

______p. Rafter used in an internal angle of a roof to form a valley

______q. Cutout near the bottom of a rafter which fits over the double plate

2. Identify the roofing members pictured below by writing the correct names in the blanks provided.

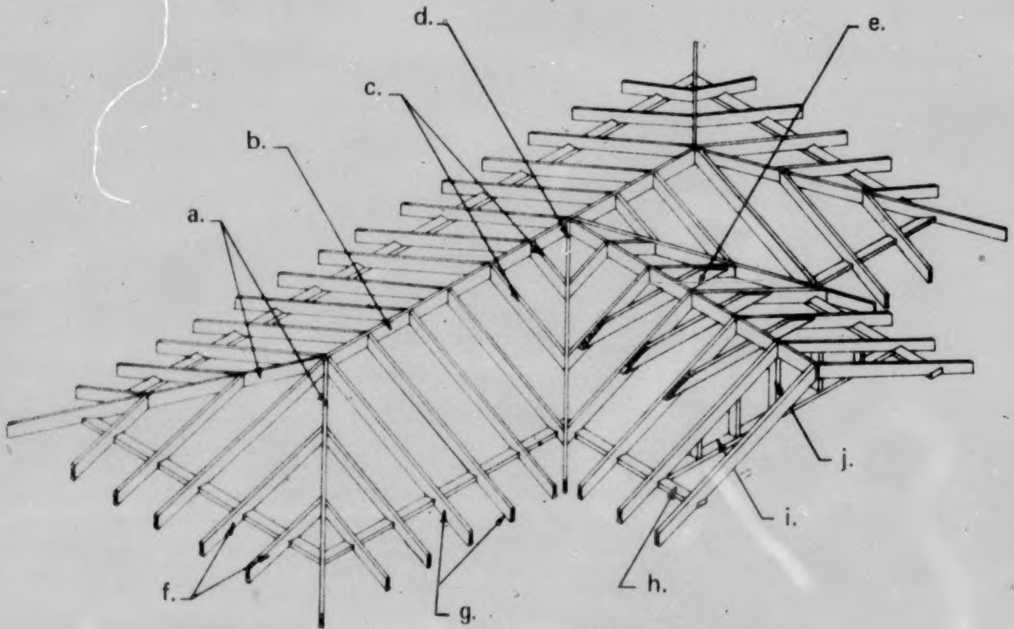
a. ______________________________ f. ______________________________

b. ______________________________ g. ______________________________

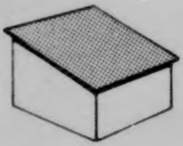
c. ______________________________ h. ______________________________

d. ______________________________ i. ______________________________

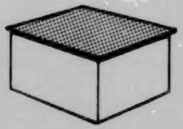
e. ______________________________ j. ______________________________



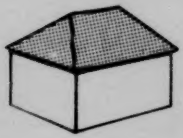
3. Identify the seven roof styles pictured below.



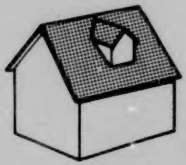
a. ______________________



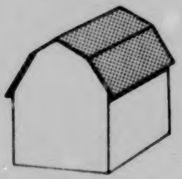
b. ______________________



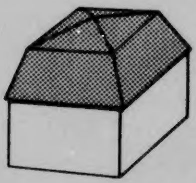
c. ______________________



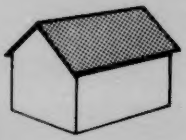
d. ______________________



e. ______________________



f. ______________________



g. ______________________

4. Match the roof framing units on the right to their correct descriptions. Place the appropriate numbers in the blanks provided.

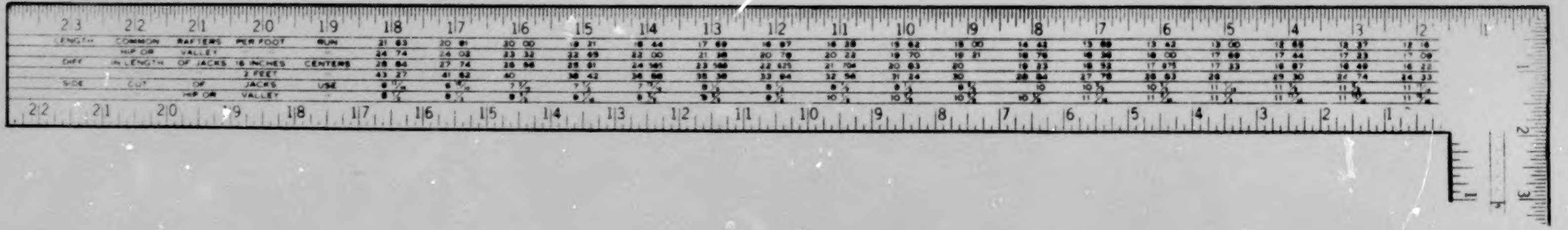
_____a. Always equals twenty-four inches	1. Unit length
_____b. Changes with slope or pitch	2. Unit rise
_____c. Always equals twelve inches	3. Unit run
_____d. Increases with rise	4. Unit span

5. List methods for determining the length of a rafter.

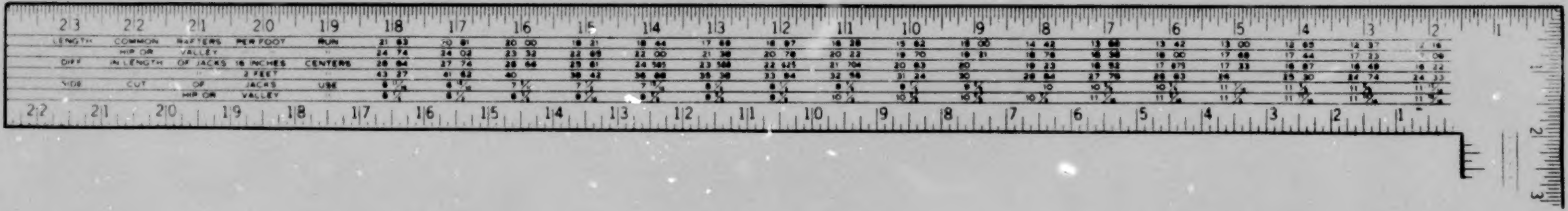
a. ______________________

b. ______________________

6. Compute the length of a common rafter for a building with a span of 26' and a rise of 8' per foot. Use the framing square table pictured below.

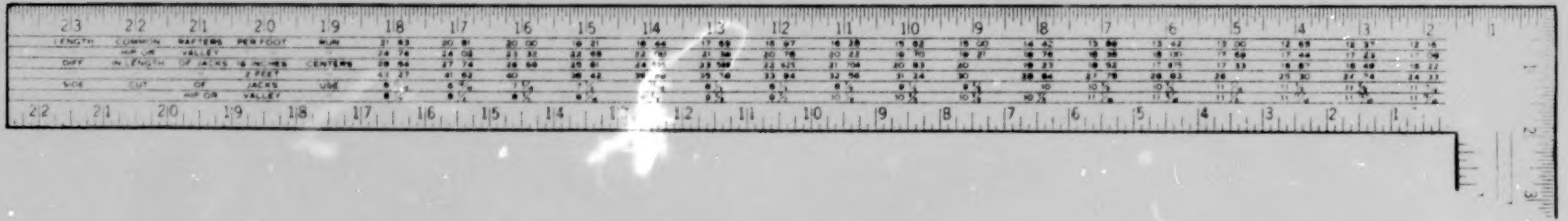


7. Compute the length of a hip rafter for a building with a run of 14' and a rise of 6" per foot. Use the framing square table pictured below.



	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
LENGTH COMMON RAFTERS PER FOOT RUN	21 63	20 81	20 00	19 21	18 44	17 69	16 97	16 28	15 62	15 00	14 42	13 89	13 42	13 00	12 65	12 37	12 16
" HIP OR VALLEY " "	24 74	24 02	23 32	22 65	22 00	21 38	20 78	20 22	19 70	19 21	18 76	18 36	18 00	17 69	17 44	17 23	17 09
DIFF IN LENGTH OF JACKS 16 INCHES CENTERS	28 84	27 74	26 66	25 61	24 585	23 588	22 625	21 704	20 83	20	19 23	18 52	17 875	17 33	16 87	16 49	16 22
" " " 2 FEET "	43 27	41 62	40	38 42	36 88	35 38	33 94	32 56	31 24	30	28 84	27 78	26 83	26	25 30	24 74	24 33
SIDE CUT OF JACKS USE	6 11/16	6 15/16	7 3/16	7 1/2	7 13/16	8 1/8	8 1/2	8 7/8	9 1/4	9 5/8	10	10 5/16	10 3/4	11 1/16	11 5/16	11 1/2	11 11/16
" " HIP OR VALLEY "	8 1/4	8 1/2	8 3/4	8 15/16	9 3/16	9 1/2	9 3/4	10 1/16	10 5/16	10 5/8	10 7/8	11 1/16	11 5/16	11 1/2	11 11/16	11 13/16	11 15/16

8. Compute length of the second jack rafter for a building with a run of 12', a span of 24', a rise of 5" per foot, and rafters on 2-foot centers. Use the framing square table pictured below.



9. Estimate the number of common rafters needed for gable roof on a building 24' wide and 36' long with a 24" roof projection over the eave and gable ends. The rafters are spaced on 24" centers.

10. Demonstrate the ability to:

    a. Lay out rafter locations on the plate and ridge on two-foot centers.

    b. Lay out, cut, and erect rafters.

    c. Apply roof sheathing.

    (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

ROOF FRAMING
UNIT III

ANSWERS TO TEST

1. a. 5
   b. 3
   c. 1
   d. 8
   e. 6
   f. 9
   g. 7
   h. 2
   i. 10
   j. 4
   k. 17
   l. 15
   m. 11
   n. 14
   o. 13
   p. 16
   q. 12

2. a. Hip rafters
   b. Ridge board
   c. Valley jacks
   d. Valley rafter
   e. Collar beam
   f. Hip jacks
   g. Common rafters

- h. Overhang
- i. Plate
- j. Gable stud

3. a. Shed or lean-to
   - b. Flat
   - c. Hip
   - d. Gable and dormer
   - e. Gambrel
   - f. Mansard
   - g. Gable

4. a. 4
   - b. 2
   - c. 3
   - d. 1

5. a. Framing square step-off method
   - b. Rafter tables from framing square

6. 15'-7 3/4"

7. 21'-0"

8. 8'-8"

9. 42 common or 38 common and 4 barge

10. Performance skills evaluated to the satisfaction of the instructor

TRUSSES
UNIT IV

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the main parts of a truss and hardware used in truss construction. The student should also be able to identify types of trusses, name methods of fabrication, and erect light frame truss for gable roof. This knowledge will be evidenced by completion of the job sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with trusses to the correct definitions.
2. Identify the main parts of a truss.
3. Identify pieces of hardware used in truss construction.
4. Identify types of trusses.
5. Name methods of fabricating trusses.
6. Demonstrate the ability to erect light frame truss for gable roof.

TRUSSES
UNIT IV

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information and job sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives and information sheet.

  E. Demonstrate and discuss procedure outlined in job sheet.

  F. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Main Parts of a Truss

    2. TM 2--Hardware Used in Truss Construction

    3. TM 3--Types of Trusses

    4. TM 4--Split Ring Connectors and Bolt Fabrication

    5. TM 5--Toothed Ring Connector and Bolt Fabrication

    6. TM 6--Gusset Fabrication

  D. Job Sheet #1--Erect Light Frame Trusses for Gable Roof

  E. Test

  F. Answers to test

III. Unit references:

  A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society. 1955.

  B. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

1549

C. Ramsey, Charles G., and Sleeper, Harold R. *Architectural Graphic Standards.* 6th ed. New York: John Wiley and Sons Inc., 1970.

TRUSSES
UNIT IV

INFORMATION SHEET

I. Terms and definitions

A. Truss--Combination of members, such as top chord, bottom chord, compression webs, and tension webs, usually arranged in triangular units for a rigid framework, for supporting loads over a long span, as in bridge or roof construction

B. Top chord--Upper member of a truss

C. Bottom chord--Bottom member of a truss

D. Tension web--Member connecting the top and the bottom chords in tension

E. Compression web--Member connecting the top and bottom chords of a truss in compression

F. Gang-nail connector plate--Steel plate from which a number of uniform nails have been stamped out to protrude at right angles from the plate itself

(NOTE: Gang-nail connector plates are also called *gang nails*. Gang-nail connector plates are a patented product of ABC Inc.)

G. Split ring--Steel ring with a tongue and grooved split in the band used to strengthen wood to wood connections in timber

(NOTE: A groove must be cut in the timber for installation.)

H. Toothed ring--Thin steel ring, corrugated and toothed, which is pressed into two wood members to strengthen the connection

I. Glue-laminated timbers--Timbers built up of thin pieces of lumber glued together and sometimes sprung to desired shapes before gluing

J. Gusset--Brace or angular bracket used to stiffen a corner or angular intersection of two or more members

K. Component--Subdivision of a unit

L. Component yard--Yard or mill specializing in the fabrication of components of a building

II. Main parts of a truss (Transparency 1)

A. Top chord

B. Bottom chord

C. Tension web

INFORMATION SHEET

D. Compression web

E. Gang-nail connector plate

III. Hardware used in truss construction (Transparency 2)

A. Split ring

B. Toothed ring connector

C. Gang-nail connector plate

D. Shear plate

E. Machine bolt

F. Plate washer

G. Malleable washers

H. Plywood gusset

IV. Types of trusses (Transparency 3)

(NOTE: Trusses can be built to fit most situations. This is a group of the most common types. All trusses may be glue-laminated.)

A. Standard Howe truss

B. Hip louver truss

C. Double W truss

D. Modified queenpost truss

E. Bowstring truss

F. Scissors truss

G. Flat trusses (Howe)

H. Flat trusses (Warren)

I. Hip truss

V. Methods of fabricating trusses (Transparencies 4, 5, and 6)

A. Gang-nailed

(NOTE: Trusses using this method are generally manufactured in a component yard.)

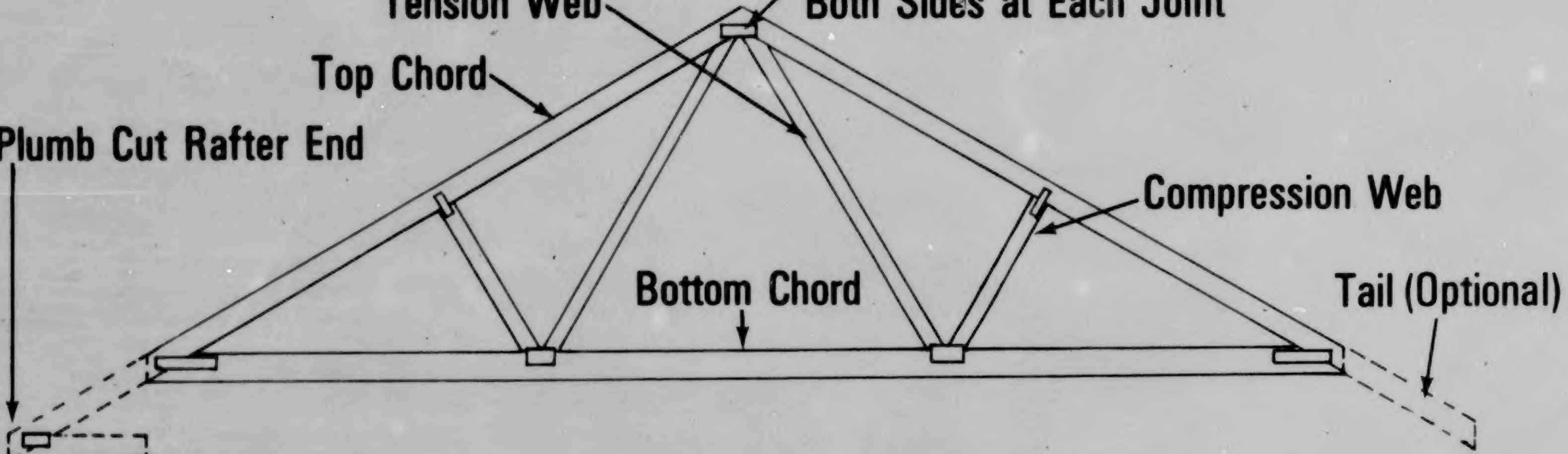
B. Split ring connector and bolt

INFORMATION SHEET

C. Toothed ring connector and bolt

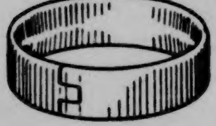
D. Gusseted

Main Parts of a Truss

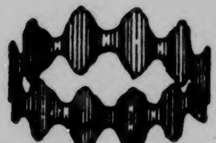


Gang-Nail Connector Plate
Both Sides at Each Joint
Tension Web
Top Chord
Plumb Cut Rafter End
Compression Web
Bottom Chord
Tail (Optional)
Tail with Return (Optional)

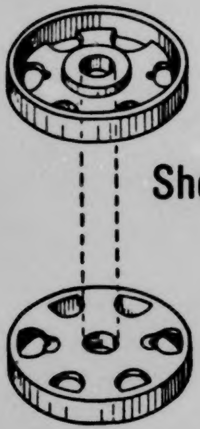
Hardware Used in Truss Construction



Split Ring



Toothed Ring Connector



Shear Plate

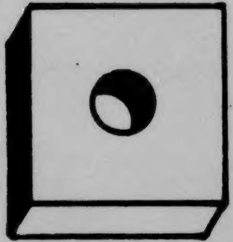
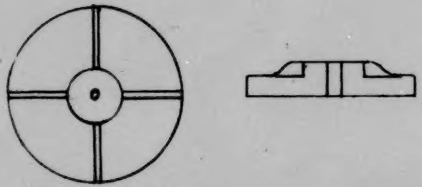
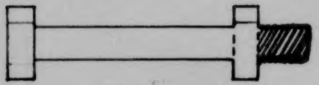


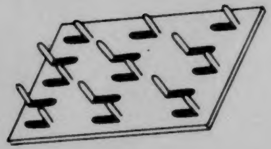
Plate Washer



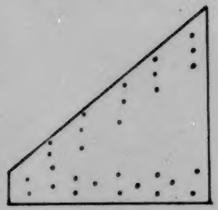
Malleable Washers



Machine Bolt

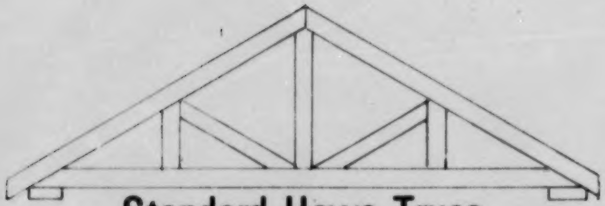


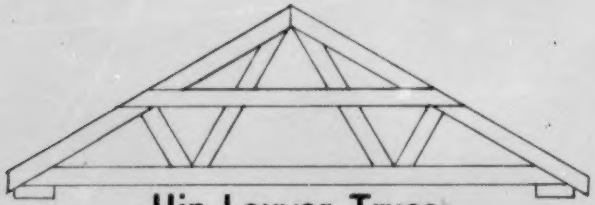
Gang Nail Connector Plate

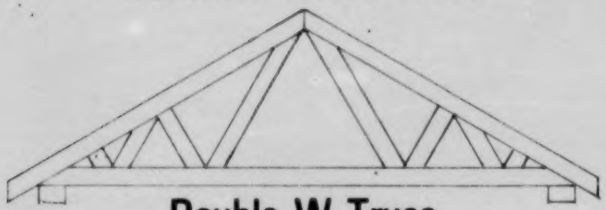


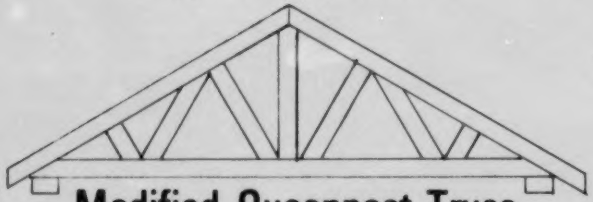
Plywood Gusset

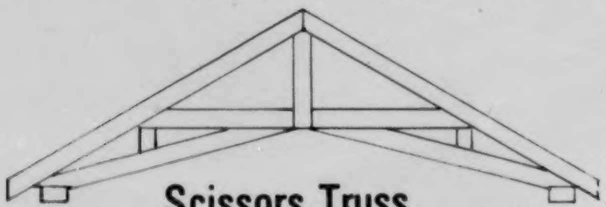
Types of Trusses

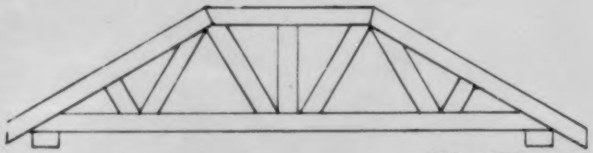

Standard Howe Truss


Hip Louver Truss

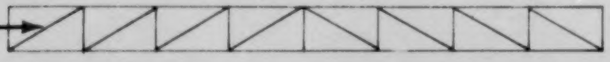

Double W Truss

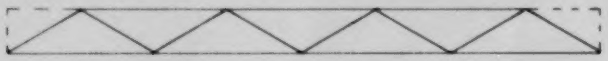

Modified Queenpost Truss

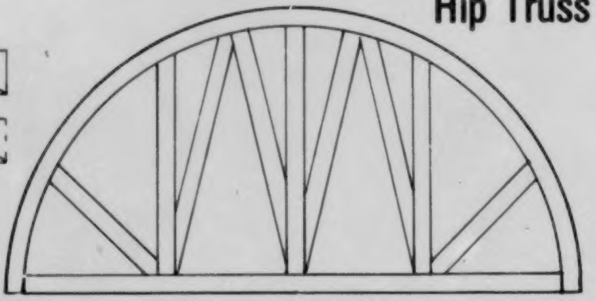

Scissors Truss


Hip Truss

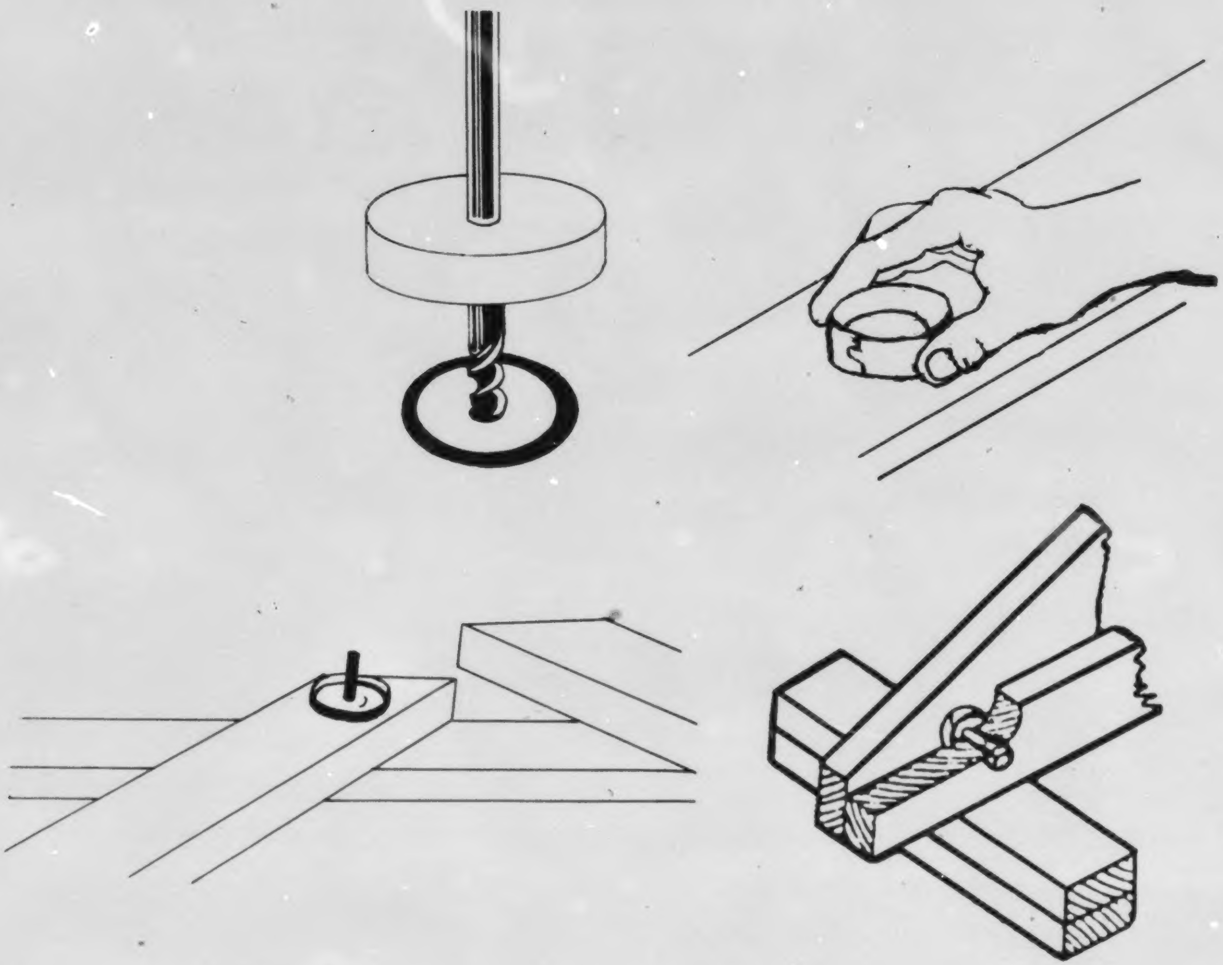
Flat Trusses (Howe)



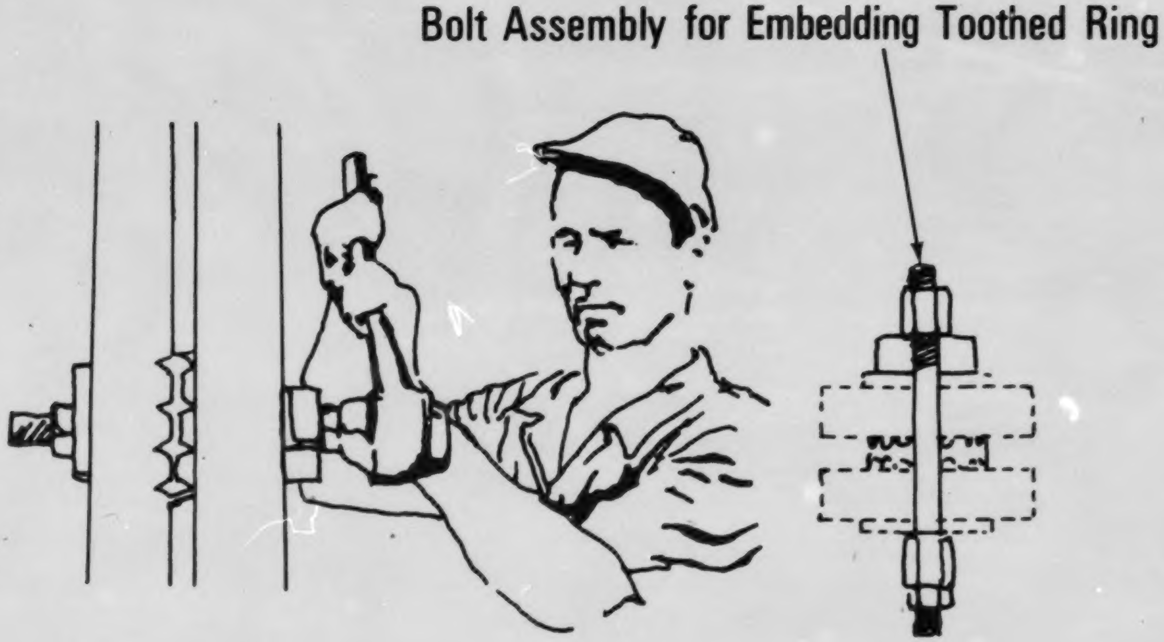

Flat Trusses (Warren)


Bowstring Truss

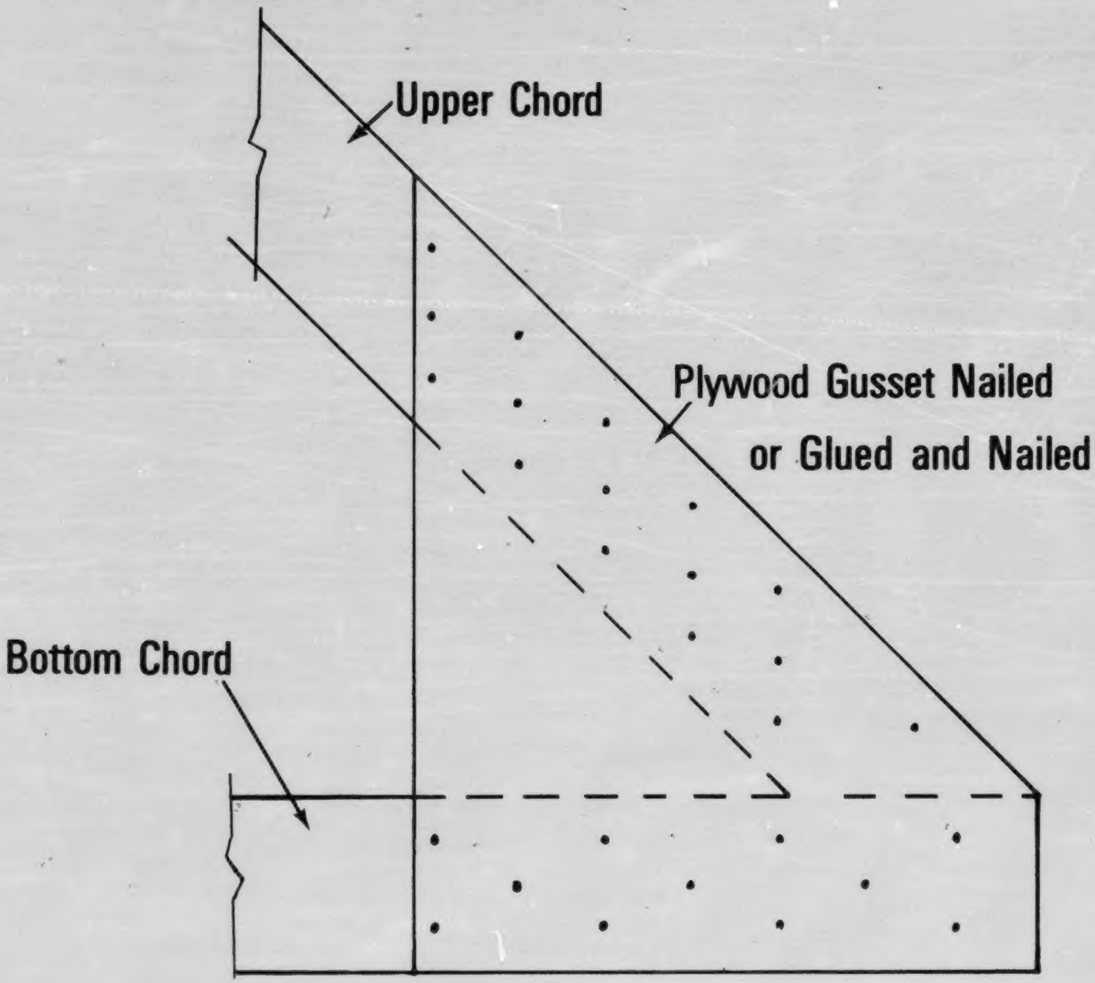
Split Ring Connectors and Bolt Fabrication



Toothed Ring Connector and Bolt Fabrication


Bolt Assembly for Embedding Toothed Ring

Gusset Fabrication


Upper Chord
Plywood Gusset Nailed
or Glued and Nailed
Bottom Chord

TRUSSES
UNIT IV

JOB SHEET #1--ERECT LIGHT FRAME TRUSS FOR GABLE ROOF

I. Tools and materials

- A. Tools
  - 1. Hammer, 16 oz or larger
  - 2. String line
  - 3. Rule
  - 4. Chalk line
  - 5. Framing square
- B. Material
  - 1. Trusses
  - 2. 2 x 4's for braces
  - 3. Nails
    - a. 16d
    - b. 8d
  - 4. 1 x 6's or plywood for catwalk

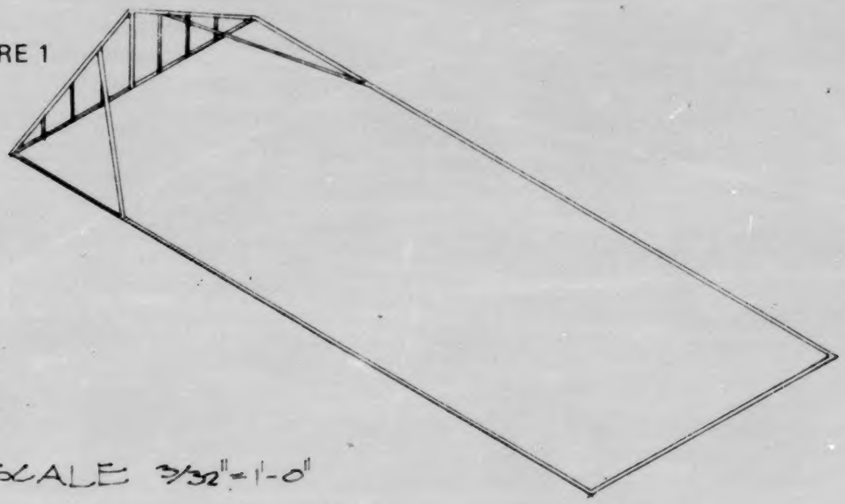
II. Procedure

- A. Measure in one inch and mark plates; then strike line
- B. Use framing square to mark plates two foot on center for trusses
- C. Measure and mark trusses one inch in
- D. Set one end of trusses on one outside wall
- E. Raise opposite end of truss and set on opposite outside wall

JOB SHEET #1

F. Start from one end and plumb, brace, and nail first gable truss (Figure 1)

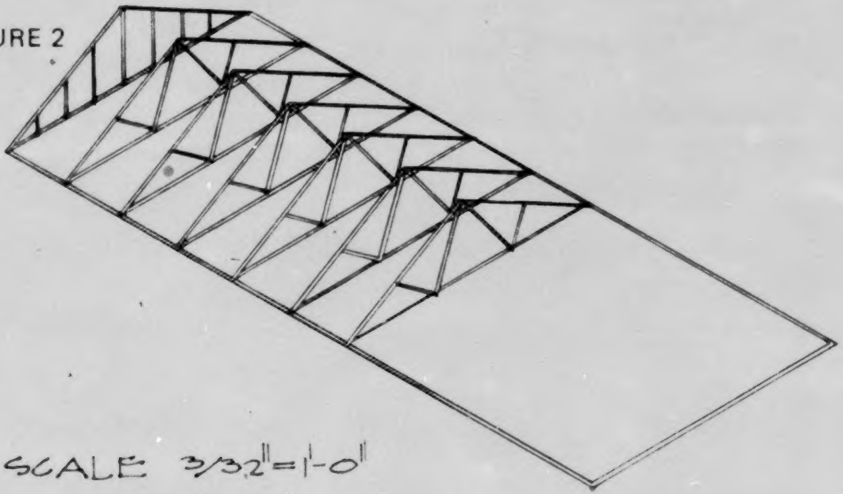
FIGURE 1



SCALE 3/32" = 1'-0"

G. Use same procedure to continue raising and nailing trusses until all are nailed except last four or five (Figure 2)

FIGURE 2



SCALE 3/32" = 1'-0"

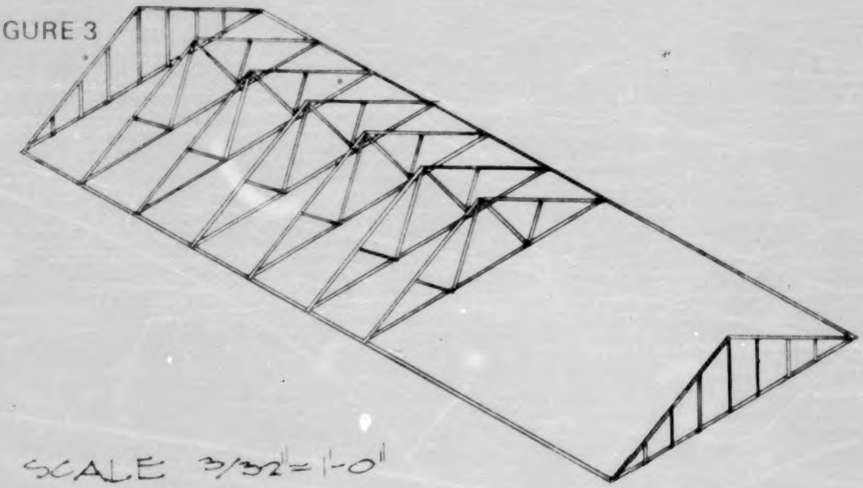
(NOTE: Occasionally, a temporary brace will have to be nailed across tops of trusses to keep them from racking.)

H. Move to other end and set gable truss

JOB SHEET #1

I. Plumb, brace, and nail truss (Figure 3)

FIGURE 3



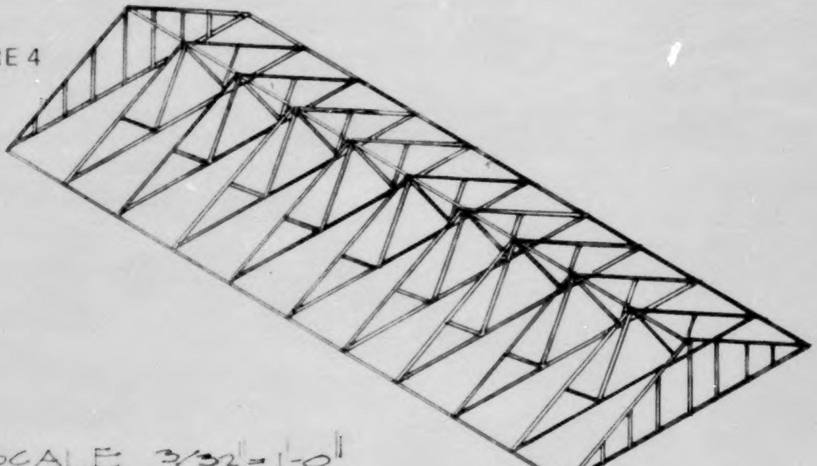
SCALE 3/32" = 1'-0"

J. Continue raising and nailing trusses until complete

K. Pull line through top of ridge and check that ridge is straight

L. Recheck trusses at top for two foot on center and add braces if necessary (Figure 4)

FIGURE 4



SCALE 3/32" = 1'-0"

M. Lay out and nail in catwalk

N. Start sheathing

(NOTE: Do not remove temporary bracing until you have worked up to the bracing.)

TRUSSES
UNIT IV

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______ a. Yard or mill specializing in the fabrication of components of a building

______ b. Member connecting the top and bottom chords in tension

______ c. Brace or angular bracket used to stiffen a corner or angular intersection of two or more members

______ d. Steel ring with a tongue and grooved split in the band used to strengthen wood to wood connections in timber

______ e. Member connecting the top and bottom chords of a truss in compression

______ f. Subdivision of a unit

______ g. Timbers built up of thin pieces of lumber glued together and sometimes sprung to desired shapes before gluing

______ h. Combination of members, such as top chord, bottom chord, compression webs, and tension webs, usually arranged in triangular units for a rigid framework, for supporting loads over a long span, as in bridge or roof construction

______ i. Steel plate from which a number of uniform nails have been stamped out to protrude at right angles from the plate itself

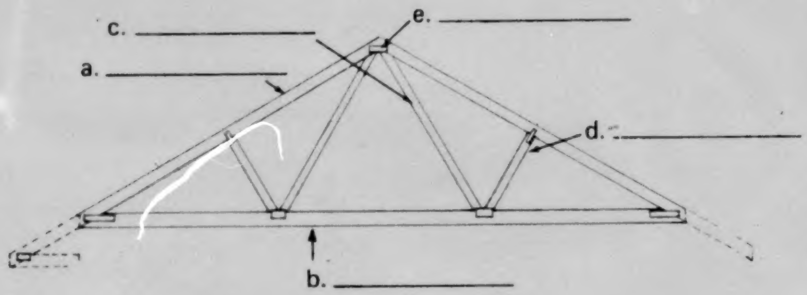
______ j. Bottom member of a truss

______ k. Thin steel ring, corrugated and toothed, which is pressed into two wood members to strengthen the connection

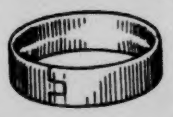
______ l. Upper member of a truss

1. Truss
2. Top chord
3. Bottom chord
4. Tension web
5. Compression web
6. Gang-nail connector plate
7. Split ring
8. Toothed ring
9. Glue-laminated timbers
10. Gusset
11. Component
12. Component yard

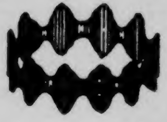
2. Identify the main parts of a truss by writing the correct names in the blanks provided.



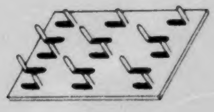
3. Identify the following pieces of hardware used in truss construction.



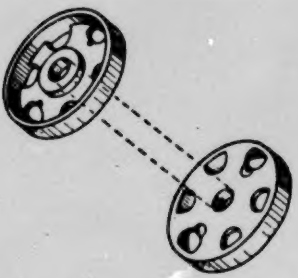
a. ____________



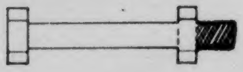
b. ____________



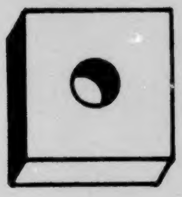
c. ____________



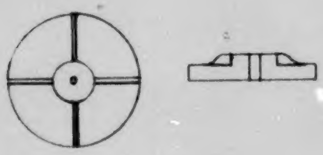
d. ____________



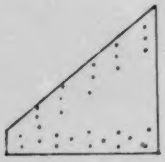
e. ____________



f. ____________

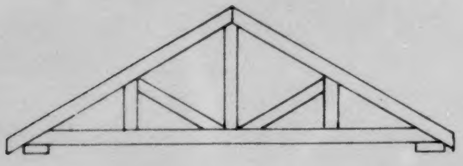


g. ____________

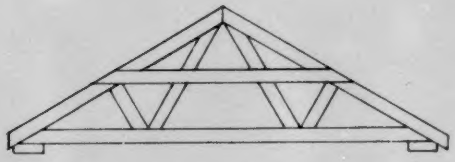


h. ____________

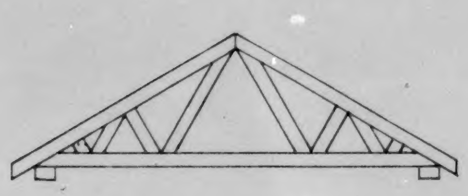
4. Identify the types of trusses shown below by writing the correct names in the blanks provided.



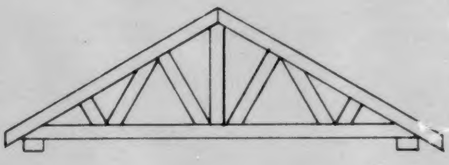
a. ____________________



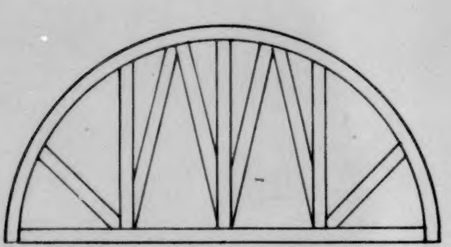
b. ____________________



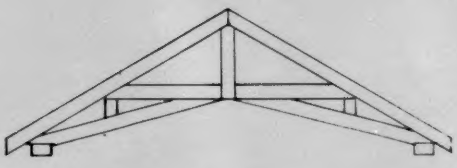
c. ____________________



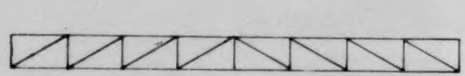
d. ____________________



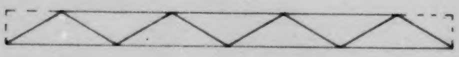
e. ____________________



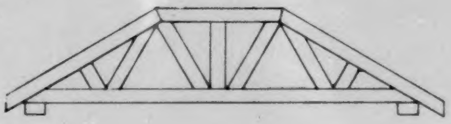
f. ____________________



g. ____________________



h. ____________________



i. ____________________

5. Name the methods of fabricating trusses.

   a. ______________________________

   b. ______________________________

   c. ______________________________

   d. ______________________________

6. Demonstrate the ability to erect light frame truss for gable roof.

   (NOTE: If the above activity has not been accomplished prior to the test, ask your instructor when it should be completed.)

TRUSSES
UNIT IV

ANSWERS TO TEST

1. a. 12
   - b. 4
   - c. 10
   - d. 7
   - e. 5
   - f. 11
   - g. 9
   - h. 1
   - i. 6
   - j. 3
   - k. 8
   - l. 2
2. a. Top chord
   - b. Bottom chord
   - c. Tension web
   - d. Compression web
   - e. Gang-nail connector plate
3. a. Split ring
   - b. Toothed ring connector
   - c. Gang-nail connector plate
   - d. Shear plate
   - e. Machine bolt
   - f. Plate washer
   - g. Malleable washers
   - h. Plywood gusset

4. a. Standard Howe truss
   b. Hip louver truss
   c. Double W truss
   d. Modified queenpost truss
   e. Bowstring truss
   f. Scissors truss
   g. Flat trusses (Howe)
   h. Flat trusses (Warren)
   i. Hip truss
5. a. Gang-nailed
   b. Split ring connector and bolt
   c. Toothed ring connector and bolt
   d. Gusseted
6. Performance skill evaluated to the satisfaction of the instructor

STRUCTURAL TIMBER CONSTRUCTION
UNIT V

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify structural components, list types of buildings in which structural timber construction is used, list factors that determine the size of timbers, and identify connecting devices and hardware items. This knowledge will be evidenced by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with structural timber construction to correct definitions.
2. List the types of buildings in which structural timber construction is used.
3. Identify the basic components used in structural timber construction.
4. List factors that have contributed to the more efficient use of structural timber in modern construction.
5. List factors that determine the size of the components in structural timber construction.
6. Identify connecting devices used with structural timbers.
7. Identify hardware items used in structural timber construction.
8. Identify types of decking.
9. Define *glue-laminated beam*.

STRUCTURAL TIMBER CONSTRUCTION
UNIT V

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information sheet.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Components of Structural Timber Construction
      2. TM 2--Connecting Devices
      3. TM 3--Connecting Devices (Continued)
      4. TM 4--Connecting Devices (Continued)
      5. TM 5--Connecting Devices (Continued)
      6. TM 6--Connecting Devices (Continued)
      7. TM 7--Hardware Items
      8. TM 8--Types of Decking
      9. TM 9--Glue-Laminated Beams

   D. Test

   E. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

B. Smith, Ronald C. *Principles and Practices of Heavy Construction*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

C. Ramsey, Charles G., and Sleeper, Harold R. *Architectural Graphic Standards*. 6th ed. New York: John Wiley and Sons, Inc., 1970.

STRUCTURAL TIMBER CONSTRUCTION
UNIT V

INFORMATION SHEET

I. Terms and definitions

- A. Heavy timber construction--Type of construction whose structural system is composed of solid stock or glue-laminated timbers which offer a significant degree of fire resistance by limiting the minimum cross sectional dimension of members and decking
- B. Wood beam--Timber or glue-laminated members used in a horizontal position to transfer floor or roof loads to columns
- C. Decking--Any lumber generally 2" or thicker laid as the roof or floor of a structure
- D. Connection--Mechanical means of connecting timbers to each other or to a fixed object
- E. Split ring--Steel ring with a tongue and groove split in the band
- F. Shear plate--Round steel plate used primarily for connecting wood to nonwood
- G. Wood column--Timbers or glue-laminated timbers used in vertical position to support beams
- H. Purlin--Horizontal timbers supporting the common rafters in roofs
- I. Laminate--To make by uniting superimposed layers of one or more materials

II. Types of buildings in which structural timber construction is used

- A. Industrial
- B. Commercial
- C. Institutional

III. Components used in structural timber construction (Transparency 1)

- A. Column
- B. Beam
- C. Decking
- D. Ledger

INFORMATION SHEET

IV. Factors contributing to more efficient use of structural timber in modern construction

- A. Development and refinement of stress-graded timber, both solid and glue-laminated
- B. Production of modern types of timber connectors
- C. Full recognition of fire resistance of large timber sections
- D. Use of preservatives to help timber withstand the deteriorating effects of moisture, disease, and insects

V. Factors determining size of components in structural timber construction

- A. Load
- B. Span of girders, beams, and decking
- C. Unsupported height of columns
- D. Grade and species of timber

VI. Connecting devices used with structural timbers (Transparencies 2, 3, 4, 5, and 6)

- A. Metal angle (with bolt)
- B. Malleable iron shear plate
- C. Wood splice plate (with bolt)
- D. Metal splice plate (with bolt)
- E. Metal shoe connection
- F. Metal hanger
- G. Metal strap and shear plate connection
- H. Column cap
- I. Lateral tie
- J. Split ring

VII. Hardware items used in structural timber construction (Transparency 7)

- A. Anchor bolt
- B. Lag screw

1577

INFORMATION SHEET

C. Machine bolt

D. Washer

  1. Plate
  2. Malleable

E. Spike

  1. 20d
  2. 80d

VIII. Types of decking (Transparency 8)

(NOTE: Three-inch and four-inch decking may be predrilled for horizontal nailing.)

A. Tongue and groove

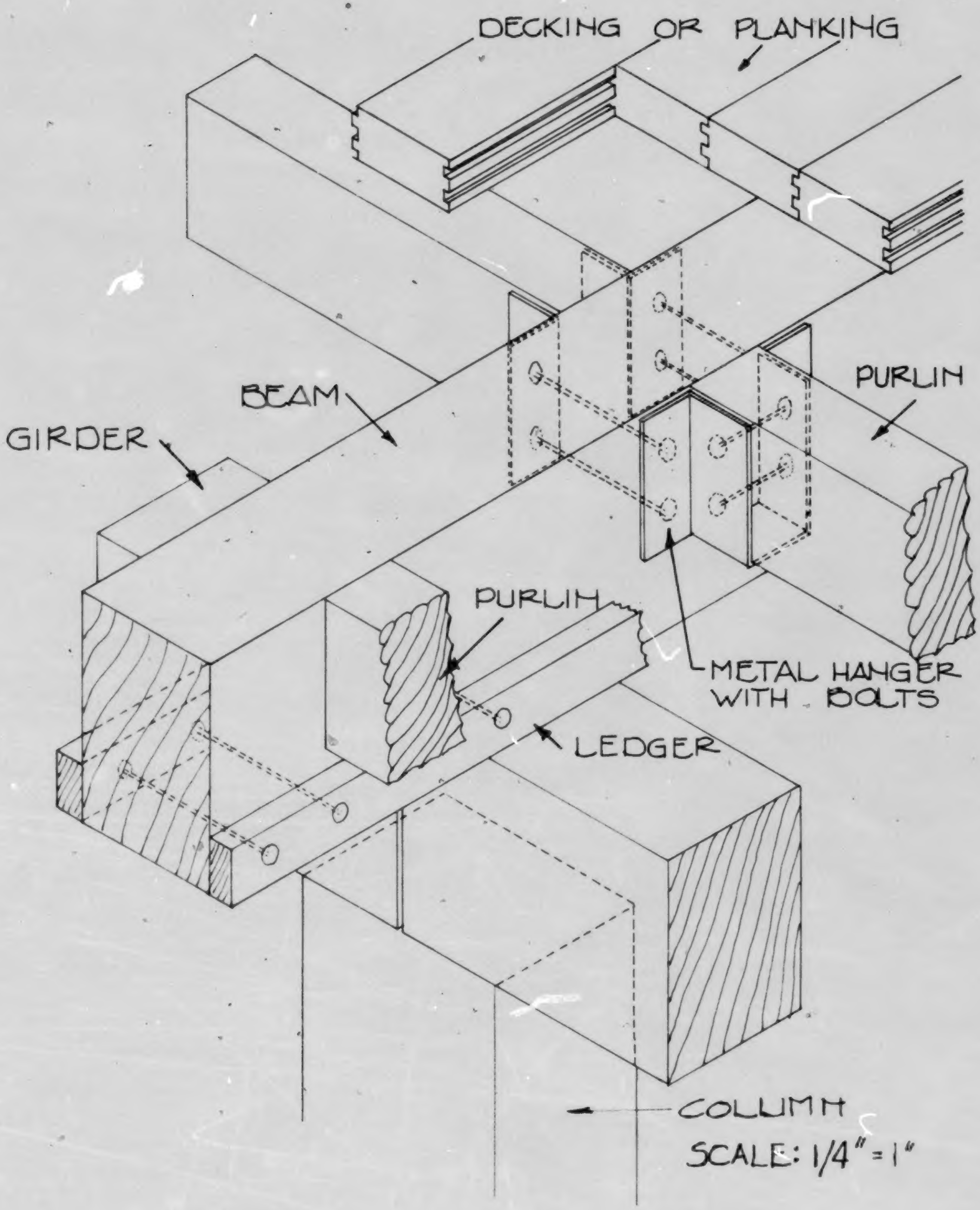
  1. 2"
  2. 3"
  3. 4"

B. Grooved for spline

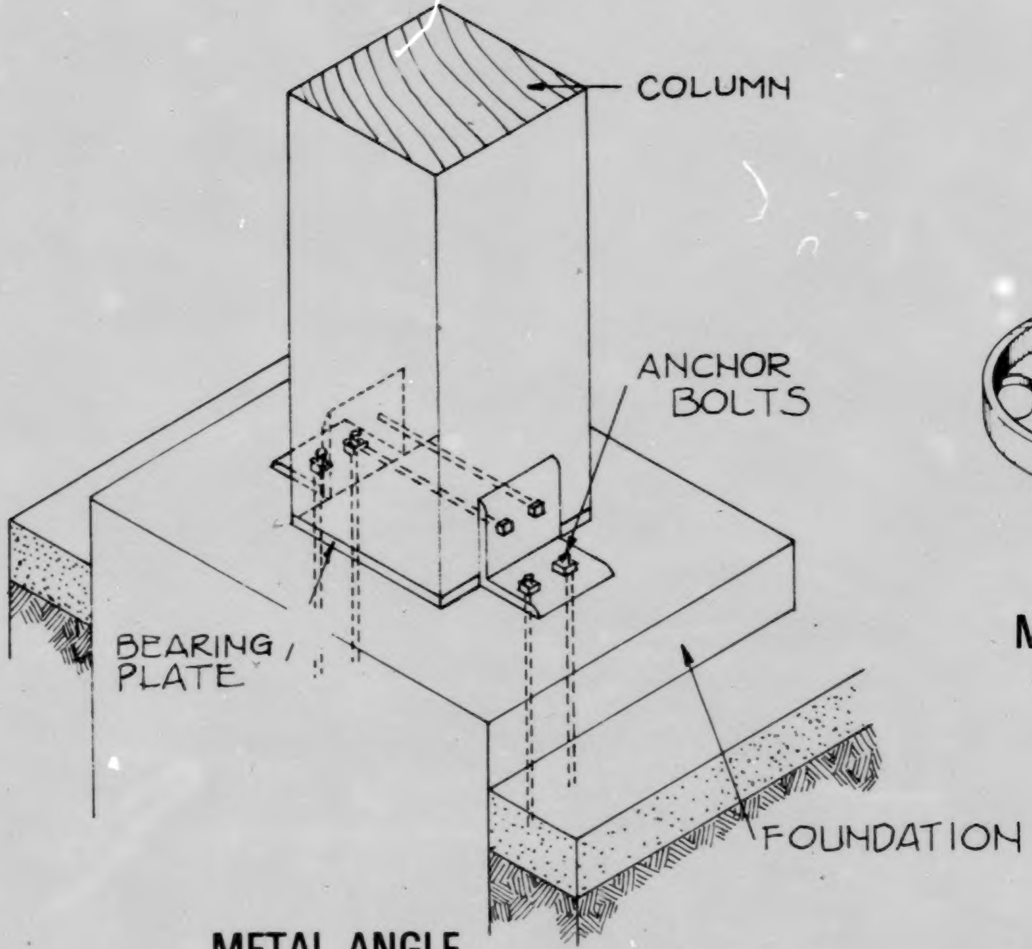
C. Laminated decking (job-site spiking or glue-laminated)

IX. Glue-laminated beam--Engineered, stress-rated product of wood laminations securely bonded together with adhesives (Transparency 9)

Components of Structural Timber Construction

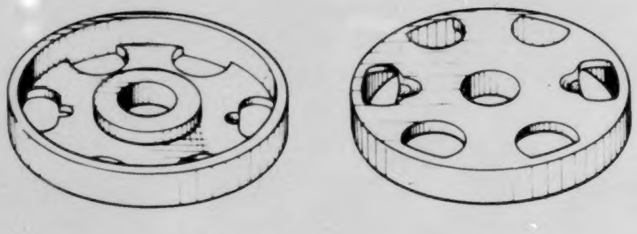

DECKING OR PLANKING
PURLIN
BEAM
GIRDER
PURLIN
METAL HANGER WITH BOLTS
LEDGER
COLUMN
SCALE: 1/4" = 1"

Connecting Devices


COLUMN
ANCHOR BOLTS
BEARING PLATE
FOUNDATION

METAL ANGLE
(with bolt)

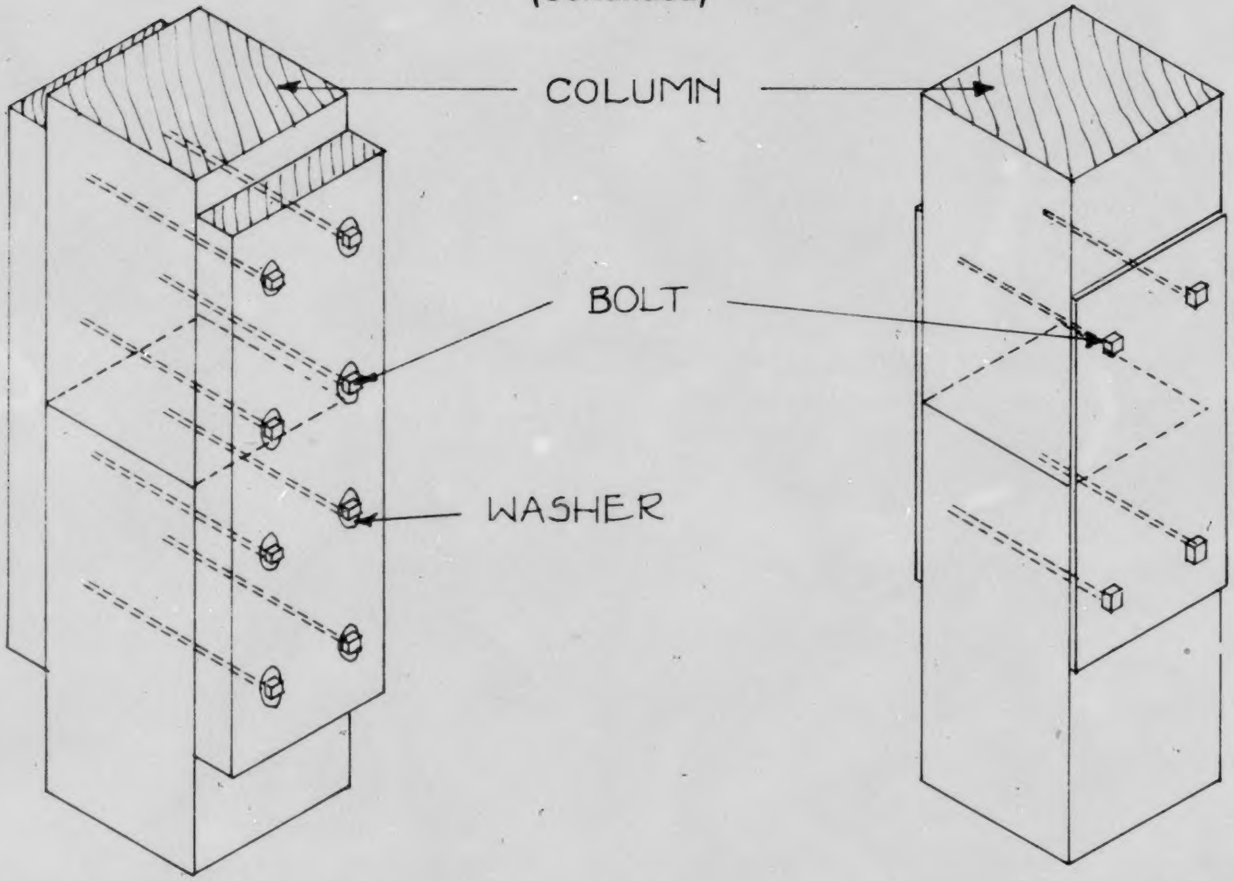
SCALE: 1/4" = 1"



MALLEABLE IRON SHEAR PLATE

Connecting Devices

(Continued)


COLUMN
BOLT
WASHER

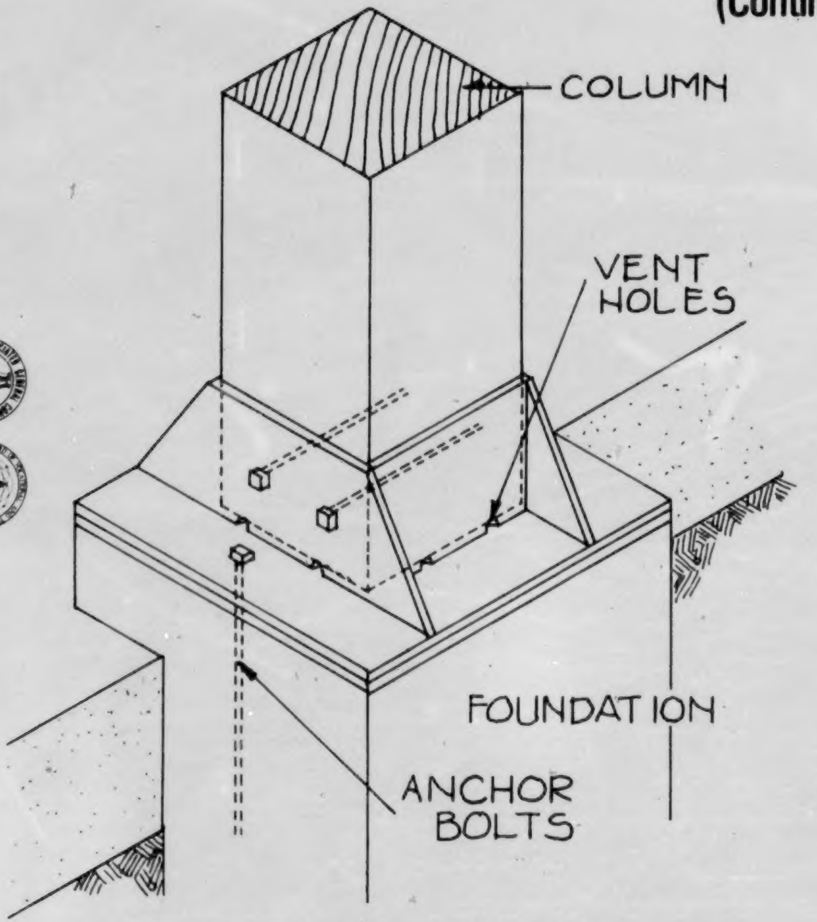
WOOD SPLICE PLATE
(with bolt)

SCALE: 1/4" = 1"

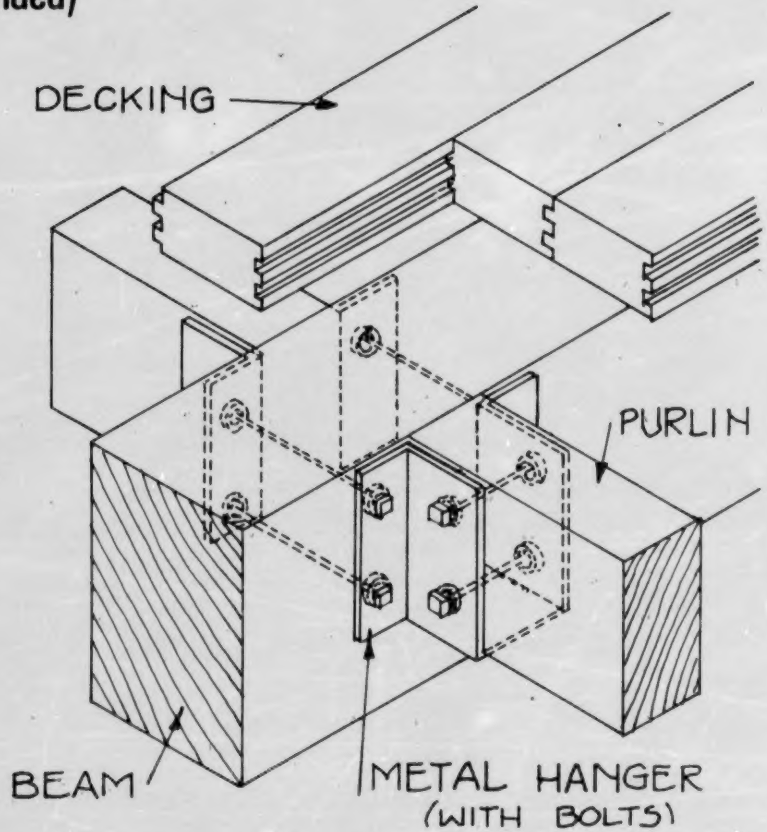
METAL SPLICE PLATE
(with bolt)

Connecting Devices

(Continued)


COLUMN
VENT HOLES
FOUNDATION
ANCHOR BOLTS

METAL SHOE CONNECTION

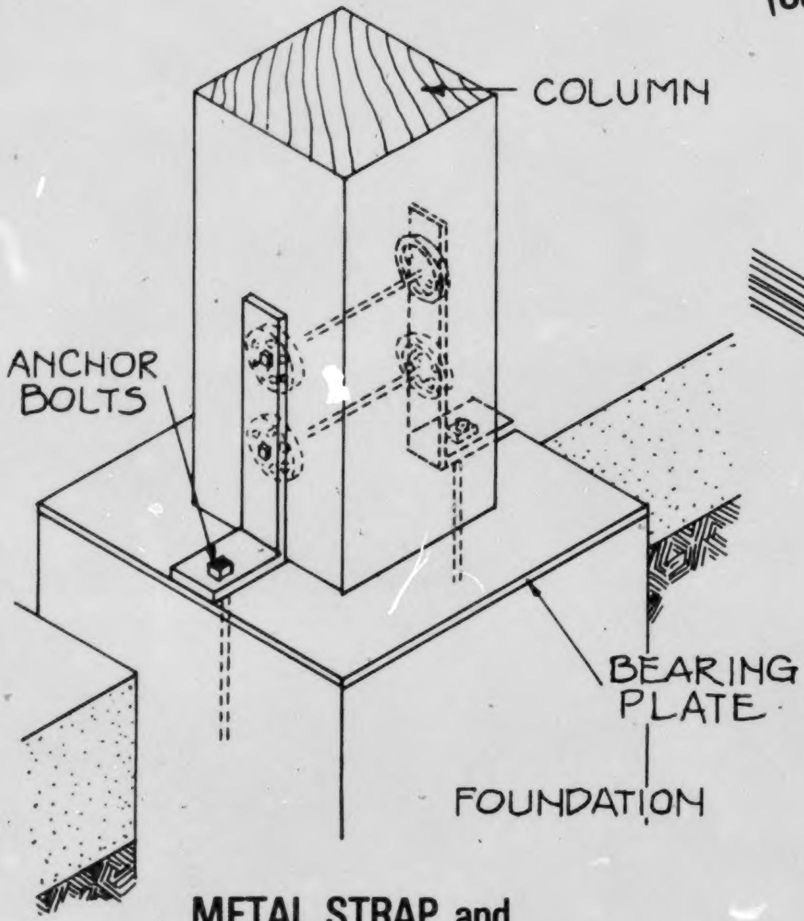

DECKING
PURLIN
BEAM
METAL HANGER (WITH BOLTS)

METAL HANGER

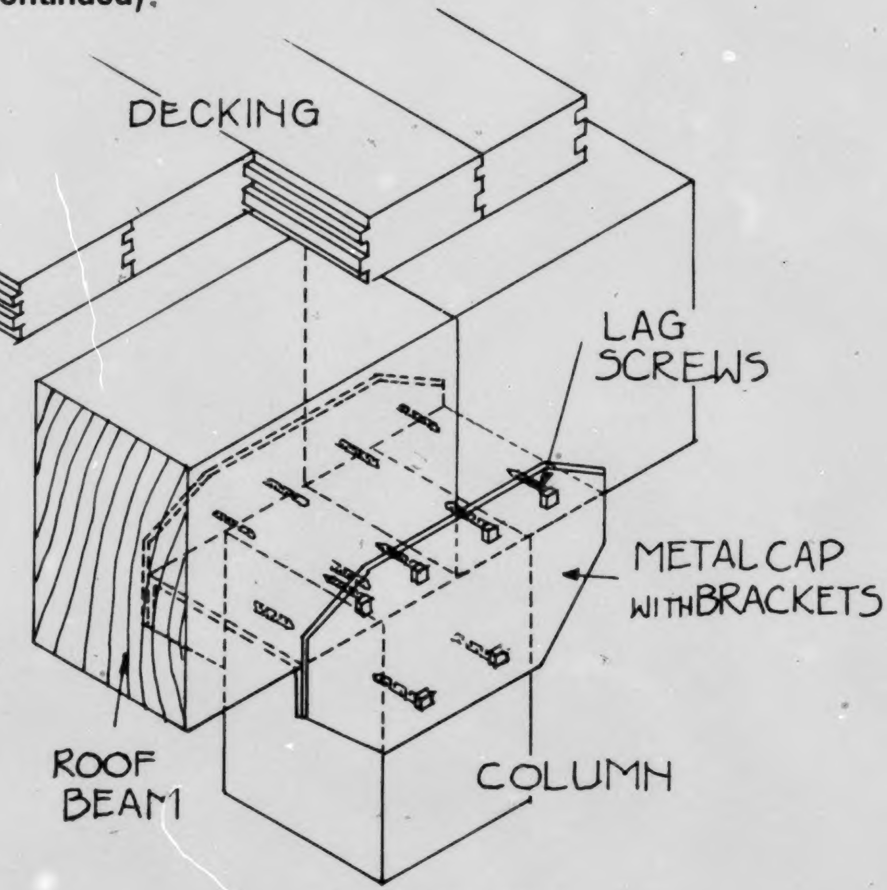
SCALE: 1/4" = 1"

Connecting Devices

(Continued).


COLUMN
ANCHOR BOLTS
BEARING PLATE
FOUNDATION

METAL STRAP and SHEAR PLATE CONNECTION

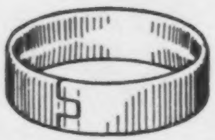

DECKING
LAG SCREWS
METAL CAP WITH BRACKETS
ROOF BEAM
COLUMN

COLUMN CAP

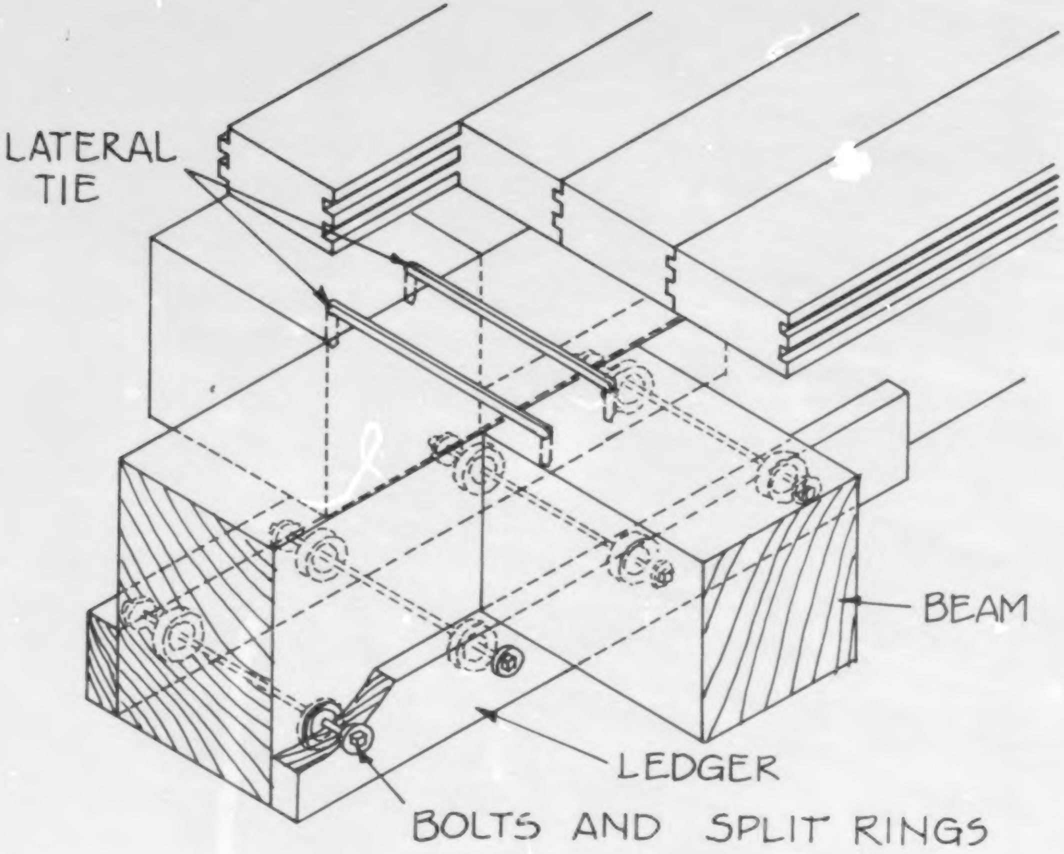
SCALE: 1/4" = 1"

Connecting Devices

(Continued)



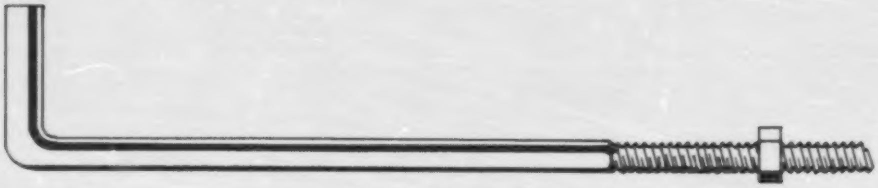
SPLIT RINGS


LATERAL TIE
BEAM
LEDGER
BOLTS AND SPLIT RINGS

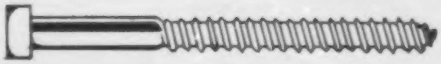
LATERAL TIES

SCALE: 1/4" - 1'

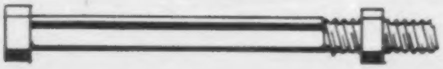
Hardware Items



ANCHOR BOLT



LAG SCREW



MACHINE BOLT

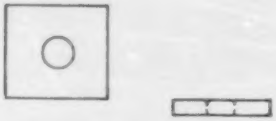
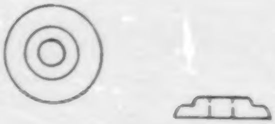
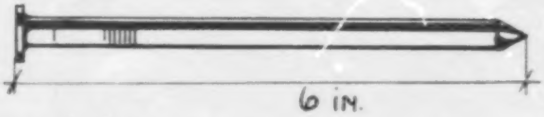


PLATE WASHER

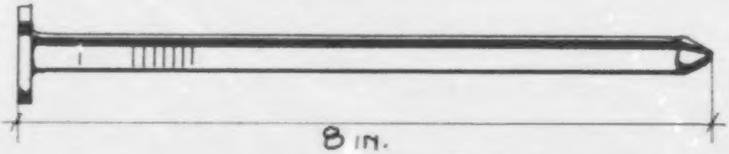


MALLEABLE WASHER



20 d

20d SPIKE

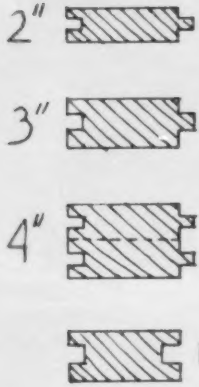


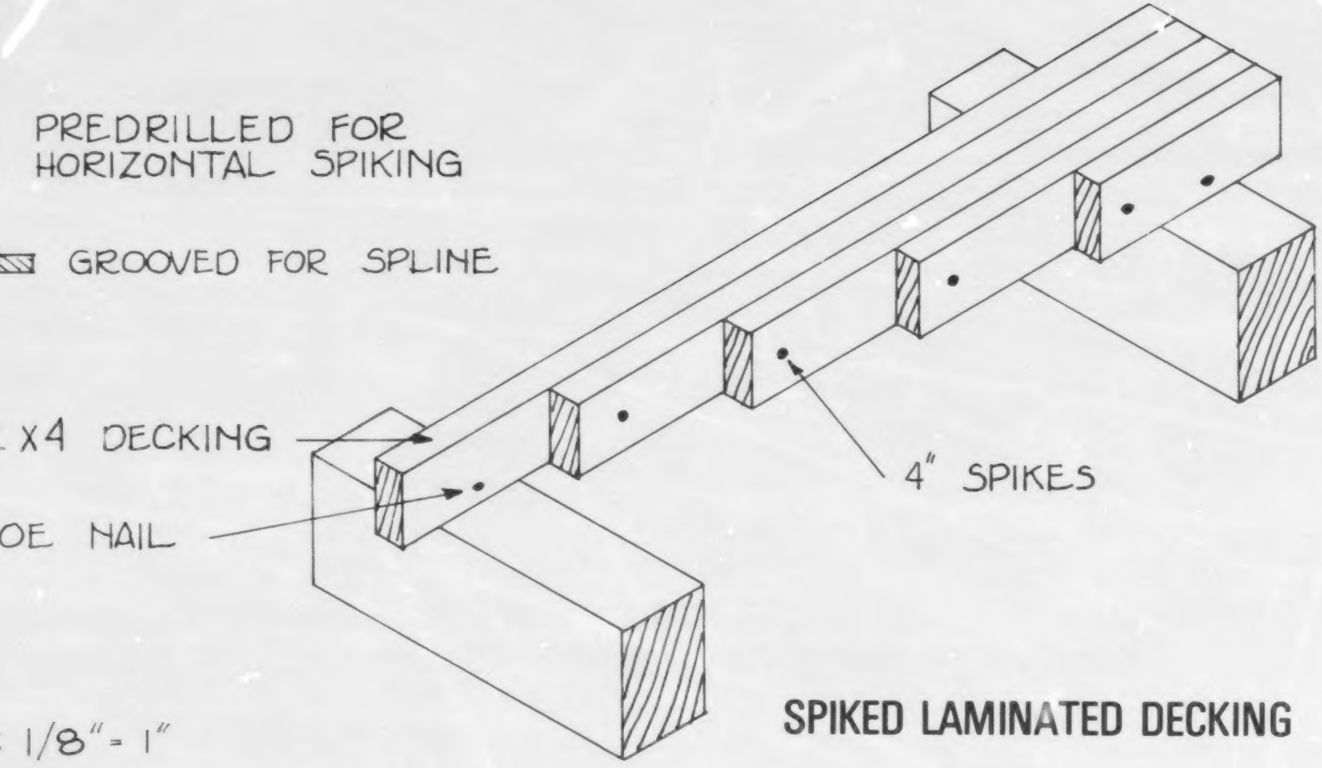
80 d

80d SPIKE

Types of Decking

TONGUE AND GROOVE

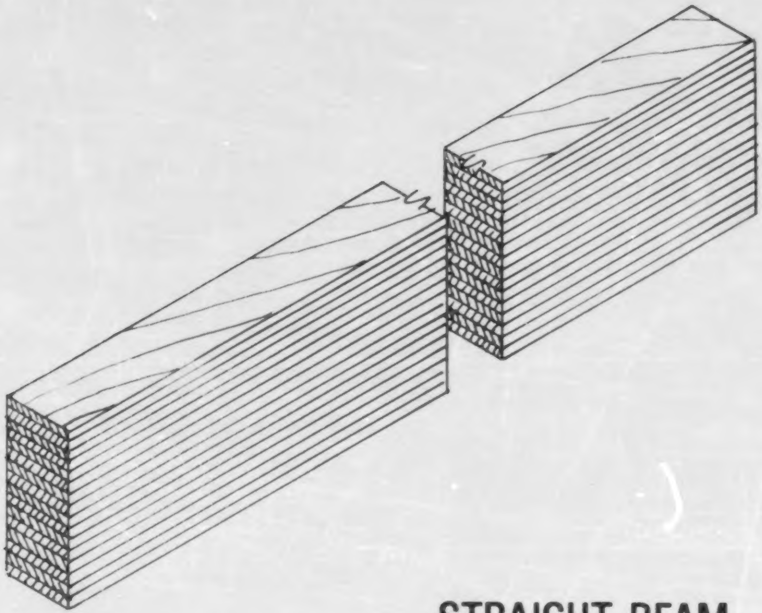

2"
3"
4"
PREDRILLED FOR HORIZONTAL SPIKING
GROOVED FOR SPLINE


2 X4 DECKING
TOE NAIL
4" SPIKES

SCALE: 1/8" = 1"

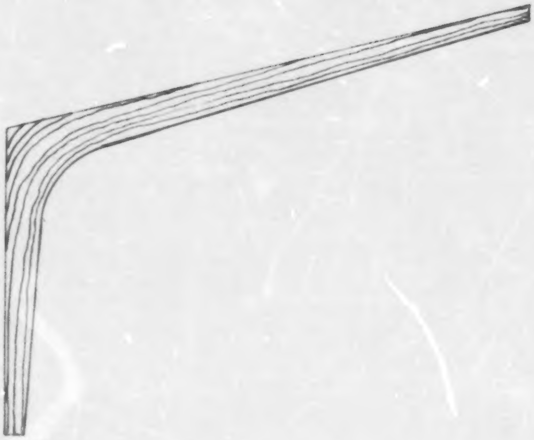
SPIKED LAMINATED DECKING

Glue-Laminated Beams



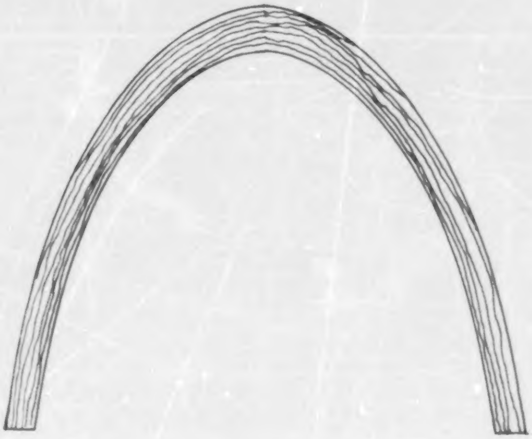
STRAIGHT BEAM

SCALE: 1" = 1'



ARCH DESIGN
HALF SPAN

SCALE: 1" = 10'



PARABOLIC ARCH DESIGN

1593

CC - 289-H

STRUCTURAL TIMBER CONSTRUCTION
UNIT V

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______ a. Round steel plate used primarily for connecting wood to nonwood

______ b. Type of construction whose structural system is composed of solid stock or glue-laminated timbers which offer a significant degree of fire resistance by limiting the minimum cross sectional dimension of members and decking

______ c. Mechanical means of connecting timbers to each other or to a fixed object

______ d. Timber or glue-laminated members used in a horizontal position to transfer floor or roof loads to columns

______ e. Timbers or glue-laminated timbers used in vertical position to support beams

______ f. Steel ring with a tongue and groove split in the band

______ g. Any lumber generally 2" or thicker laid as the floor or roof of a structure

______ h. Horizontal timbers supporting the common rafters in roofs

______ i. To make by uniting superimposed layers of one or more materials

1. Wood column
2. Wood beam
3. Decking
4. Connection
5. Split ring
6. Shear plate
7. Heavy timber construction
8. Laminate
9. Purlin

2. List the types of buildings in which structural timber construction is used.

a. ______________________________

b. ______________________________

c. ______________________________

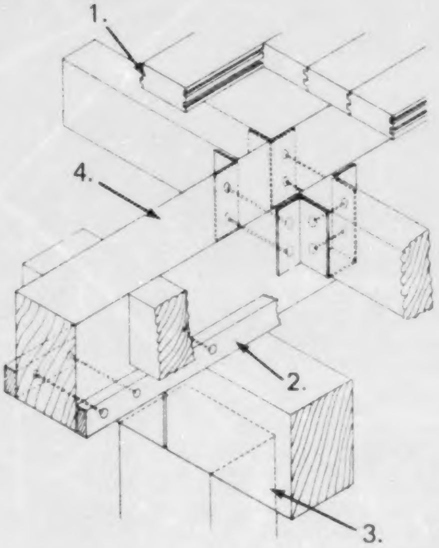
3. Identify the basic components used in structural timber construction from the illustration below by placing the correct numbers in the blanks provided.

_____a. Column

_____b. Beam

_____c. Decking

_____d. Ledger



4. List factors that have contributed to the more efficient use of structural timber in modern construction.

a. ____________________

____

b. ____________________

____

c. ____________________

____

d. ____________________

____

5. List factors that determine the size of the components in structural timber construction.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

1595

6. Identify the connecting devices in the illustration below that are used with structural timbers by placing the correct numbers in the blanks provided.

______a. Metal angle (with bolt)

______b. Malleable iron shear plate

______c. Wood splice plate (with bolt)

______d. Metal splice plate (with bolt)

______e. Metal shoe connection

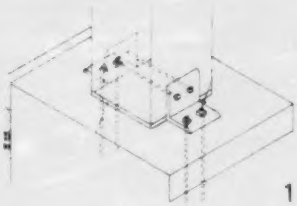
______f. Metal hanger

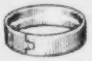
______g. Metal strap and shear plate connection

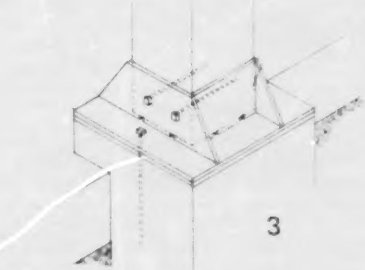
______h. Lateral tie

______i. Column cap

______j. Split ring


1


2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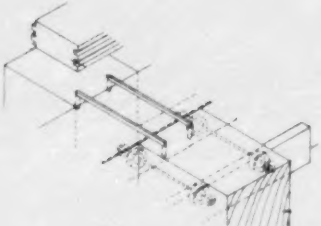
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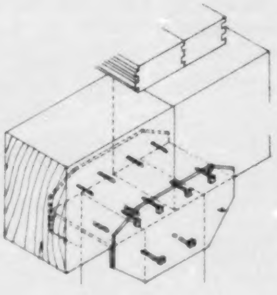
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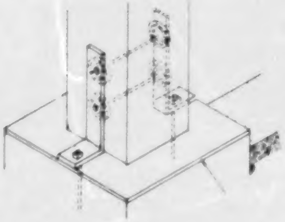
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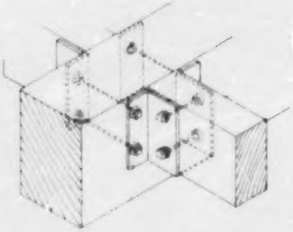
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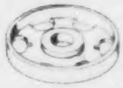
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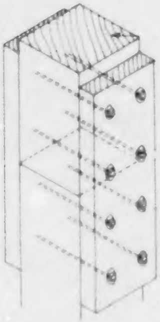
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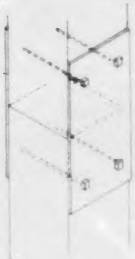

10

7. Identify the hardware items in the illustration below that are used in structural timber construction by placing the correct numbers in the blanks provided.

______a. Anchor bolt

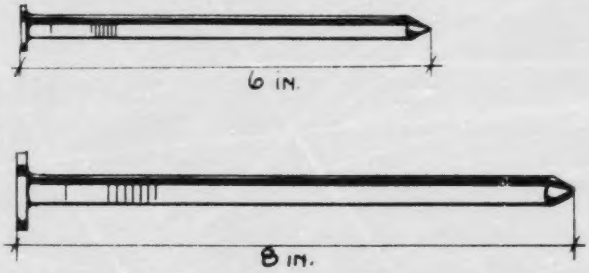
______b. Lag screw

______c. Machine bolt

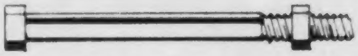
______d. Washers

______e. Spikes

1



2



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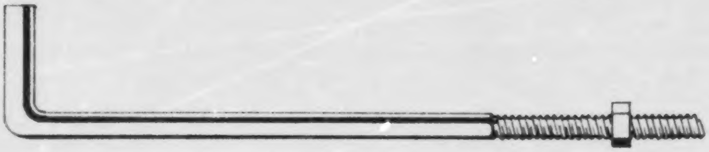

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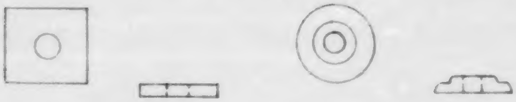

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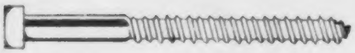
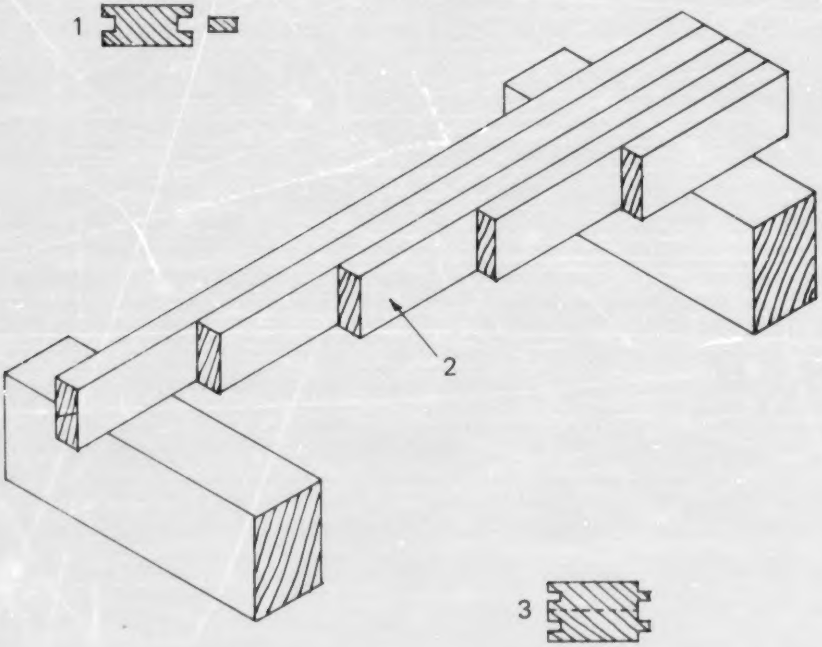


8. Identify the types of decking illustrated below by placing the correct numbers in the blanks provided.

______a. Tongue and groove

______b. Grooved for spline

______c. Laminated decking



9. Define *glue-laminated beam.*

____

____

____

STRUCTURAL TIMBER CONSTRUCTION
UNIT V

ANSWERS TO TEST

1. a. 6
    b. 7
    c. 4
    d. 2
    e. 1
    f. 5
    g. 3
    h. 9
    i. 8
2. a. Industrial
    b. Commercial
    c. Institutional
3. a. 3
    b. 4
    c. 1
    d. 2
4. a. Development and refinement of stress-graded timber, both solid and glue-laminated
    b. Production of modern types of timber connectors
    c. Full recognition of fire resistance of large timber sections
    d. Use of preservatives to help timber withstand the deteriorating effects of moisture, disease, and insects
5. a. Load
    b. Span of girders, beams, and decking

c. Unsupported height of columns

d. Grade and species of timber

6. a. 1

b. 8

c. 9

d. 10

e. 3

f. 7

g. 6

h. 4

i. 5

j. 2

7. a. 3

b. 5

c. 2

d. 4

e. 1

8. a. 3

b. 1

c. 2

9. Engineered, stress-rated product of wood laminations securely bonded together with adhesives

1600

FIREPROOF METAL STUD CONSTRUCTION
UNIT VI

UNIT OBJECTIVE

After completion of this unit, the student should be able to name fasteners used on this type of construction, name components of metal stud construction, lay out wall lines for steel studs and install metal door bucks, and install steel studs. This knowledge will be evidenced by completion of job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Define *fireproof metal stud construction.*
2. Match terms associated with fireproof metal stud construction to the correct definitions.
3. Name fasteners used for metal stud construction.
4. Name components of a metal stud system.
5. Demonstrate the ability to:
    a. Lay out wall lines for steel studs and install metal door bucks.
    b. Install steel studs.

FIREPROOF METAL STUD CONSTRUCTION
UNIT VI

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

- A. Provide students with objective sheet.
- B. Provide students with information and job sheets.
- C. Make transparencies.
- D. Discuss unit and specific objectives.
- E. Discuss information sheet.
- F. Demonstrate and discuss procedures outlined in job sheets.

  (CAUTION: Some states require a safety card to operate powder actuated tools.)
- G. Give test.

II. Instructional materials:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
  1. TM 1--Fasteners for Metal Stud Construction
  2. TM 2--Components of a Metal Stud System
- D. Job sheets
  1. Job Sheet #1--Lay Out Wall Lines for Steel Studs and Install Metal Door Bucks
  2. Job Sheet #2--Install Metal [illegible]
- E. Test
- F. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago, Illinois: American Technical Society, 1955.

B. Smith, Ronald C. *Principles and Practices of Heavy Construction.* Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

C. Ramsey, Charles G., and Sleeper, Harold R. *Architectural Graphic Standards.* 6th ed. New York: John Wiley and Sons, Inc., 1970.

FIREPROOF METAL STUD CONSTRUCTION
UNIT VI

INFORMATION SHEET

I. Fireproof metal stud construction--Method of construction in which the main units are masonry and all other components are of noncombustible material

II. Terms and definitions

   A. Runner--Channel used to anchor the studs at floor and ceiling

   B. Magnetic driver--Tool used to hold short concrete nails while they are being driven

   C. Modular dimensional standards--Standards based upon a common unit of measure of four inches, known as a *module*, used as a base for the grid which is essential for dimensional coordination of two or more different materials

   (NOTE: Dimensional standards are approved by the American Standards Association for all building materials and equipment.)

   D. Cutter--Hand-operated tool used to cut studs and runners on the job

   E. Crimper--Hand-operated tool used to attach studs to runners by crimping

   F. Sheetrock screwdriver--Electric screwdriver with a special head

   G. Drive pin--Type of fastener driven with a powder actuated tool

   H. Buck brace--Manufactured product with a clamp on each end that is adjustable for length; a piece of wood

III. Fasteners used for metal stud construction (Transparency 1)

   A. Concrete nails

   B. Masonry nails

   C. Drive pins

   D. Toggle bolts

   E. Screws

      1. Gypsum panel to standard metal framing, 1" type S Bugle Head

      2. Metal studs to door jamb anchor clips, 3/8" type S-12 Pan Head

INFORMATION SHEET

3. Metal studs to door jamb anchor clips, 1/2" type S-12 Pan Head
4. Standard metal studs to runners, 3/8" type S Pan Head

IV. Components of a metal stud system (Transparency 2)

A. Studs

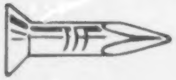
B. Runners

C. Metal door buck anchor clips

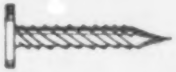
1605

Fasteners for Metal Stud Construction

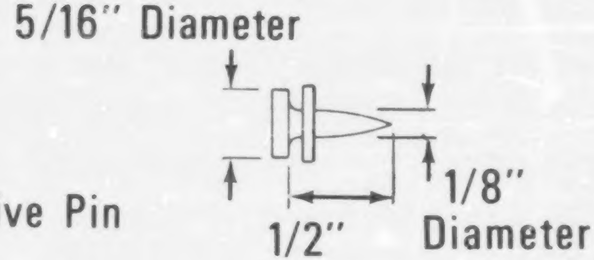
Concrete Nail



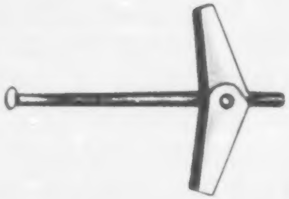
Masonry Nail



Drive Pin

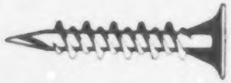

5/16" Diameter
1/8" Diameter
1/2"

Toggle Bolt

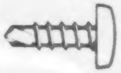


SCREWS

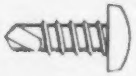
1" Type S Bugle Head



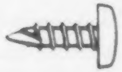
3/8" Type S-12 Pan Head



1/2" Type S-12 Pan Head



3/8" Type S Pan Head



Also available with
Hex Washer Head

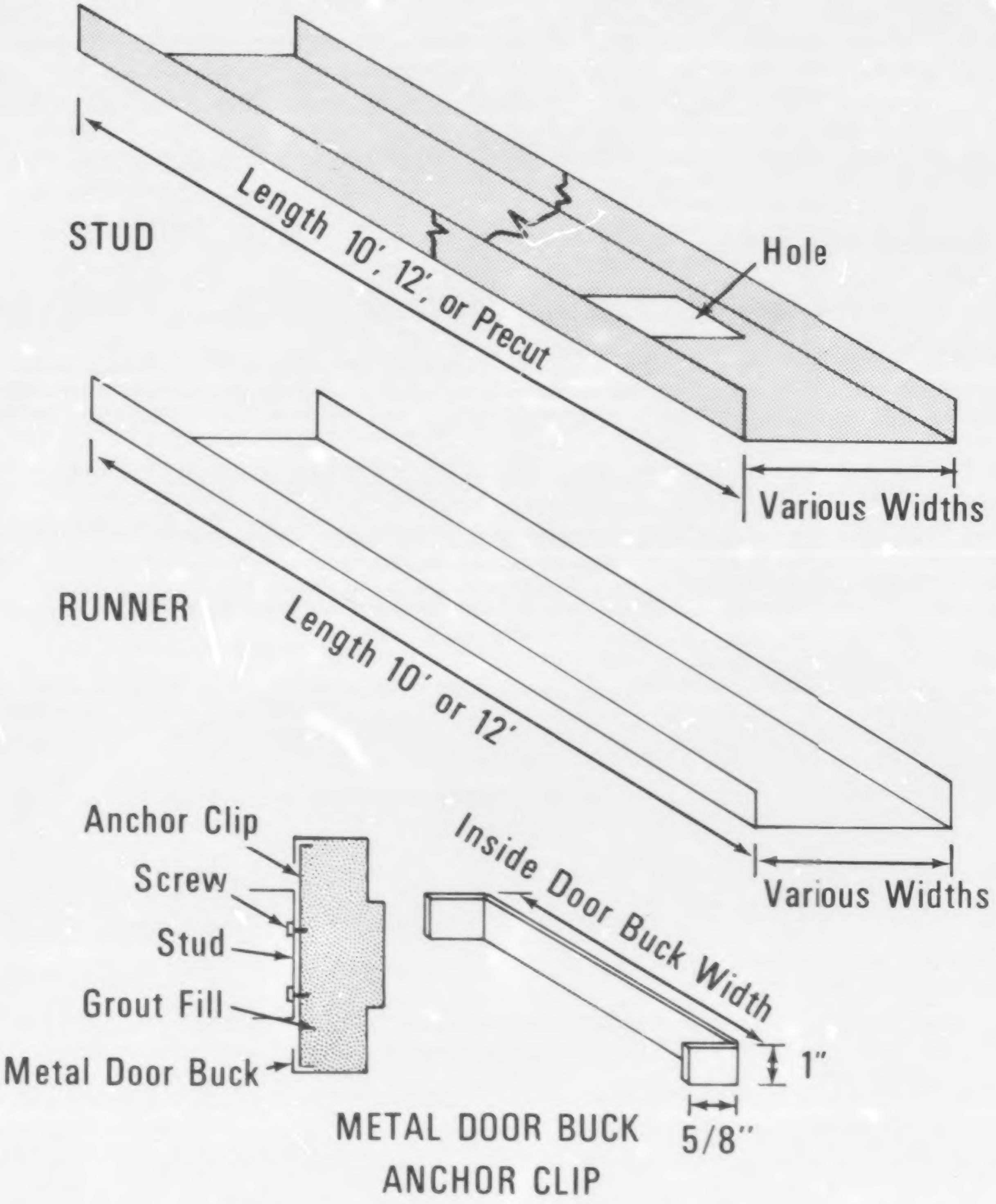
1607

CC-303-H

TM 1

1606

Components of a Metal Stud System


STUD
Length 10', 12', or Precut
Hole
Various Widths
RUNNER
Length 10' or 12'
Various Widths
Anchor Clip
Screw
Stud
Grout Fill
Metal Door Buck
Inside Door Buck Width
1"
5/8"
METAL DOOR BUCK
ANCHOR CLIP

FIREPROOF METAL STUD CONSTRUCTION
UNIT VI

JOB SHEET #1--LAY OUT WALL LINES FOR STEEL STUDS AND INSTALL METAL DOOR BUCKS

I. Tools and materials

A. Tools

1. Chalk line and reel
2. Measuring tape, 100 foot
3. Tape measure, 12 or 16 foot
4. Hand level
5. Claw hammer, 16 oz or larger
6. Powder actuated tool and drive pins

   (CAUTION: Follow safety guidelines.)

B. Materials

1. Floor plan
2. Concrete nails
3. Metal door bucks
4. Can of spray paint (red or yellow)
5. Buck braces

II. Procedure

A. Lay out exterior walls (Figure 1)

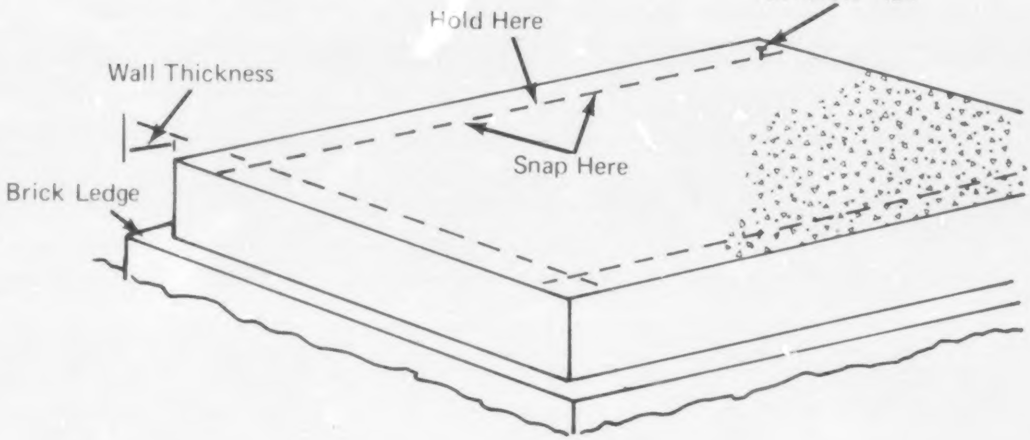
1. Measure from the outside face the total wall thickness at two corners on one side of the building
2. Drive a short concrete nail on one of the marks
3. Hook looped end of chalk line on nail

JOB SHEET #1

4. Pull chalk line tight over mark on other end and snap

   (NOTE: When snapping long lines, it is advisable to snap from the middle of the line by holding the line tight to the floor with one hand, snapping the two halves separately.)

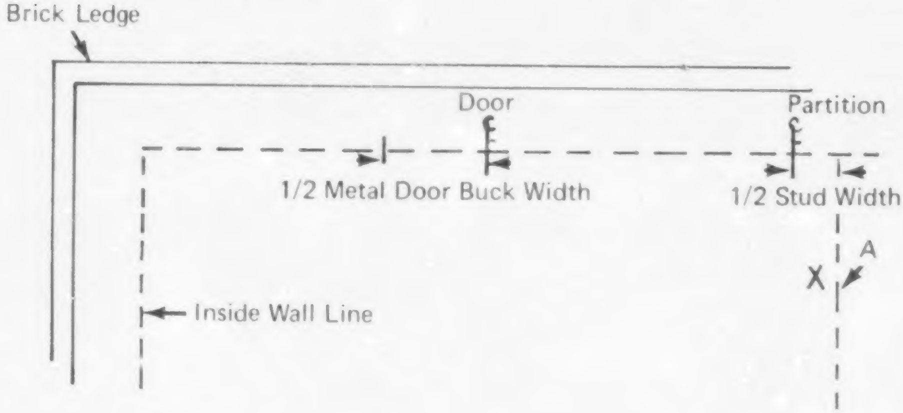
FIGURE 1


Concrete Nail
Hold Here
Wall Thickness
Snap Here
Brick Ledge

B. Lay out inside walls and doors (Figure 2)

1. Hold loop end of measuring tape on inside wall line and mark center lines of all doors and partitions

FIGURE 2


Brick Ledge
Door
Partition
1/2 Metal Door Buck Width
1/2 Stud Width
A
X
Inside Wall Line

1610

JOB SHEET #1

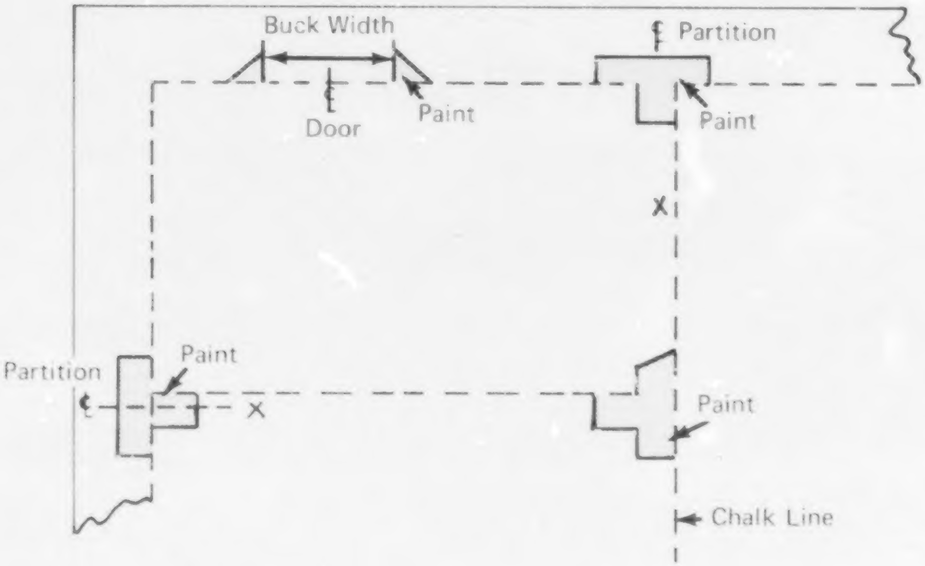
2. Repeat step 1 on opposite side of the building
3. Measure over one-half the thickness of the stud from the partition center line on both ends of the partition
4. Snap a chalk line between these points
5. Mark partition side of line with an *X*
6. Lay out all partitions following steps 1 through 5
7. Lay out center lines of all openings and partitions
8. Measure one-half the width of the metal door buck on each side of the door center lines

   (NOTE: Check from corner to door buck and adjust for modular units.)

9. Paint partition intersections and door sides (Figure 3)

   (NOTE: Lay thin boards on floor at layout lines and spray paint floor.)

FIGURE 3


Buck Width
℄ Partition
Paint
℄ Door
Paint
X
Partition ℄
Paint
X
Paint
Chalk Line

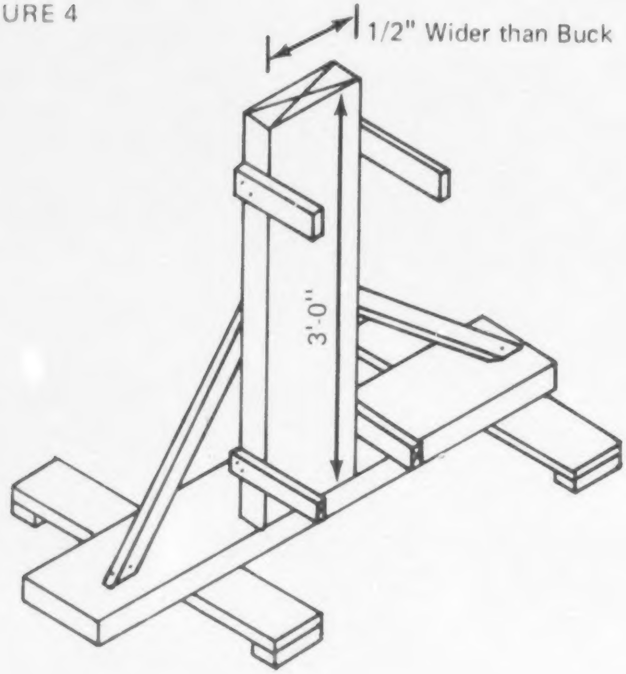
JOB SHEET #1

C. Set metal door bucks

1. Build door buck jack (Figure 4)

   (NOTE: This would only be built when a large quantity of bucks are to be set. It can not be used on exterior bucks.)

FIGURE 4

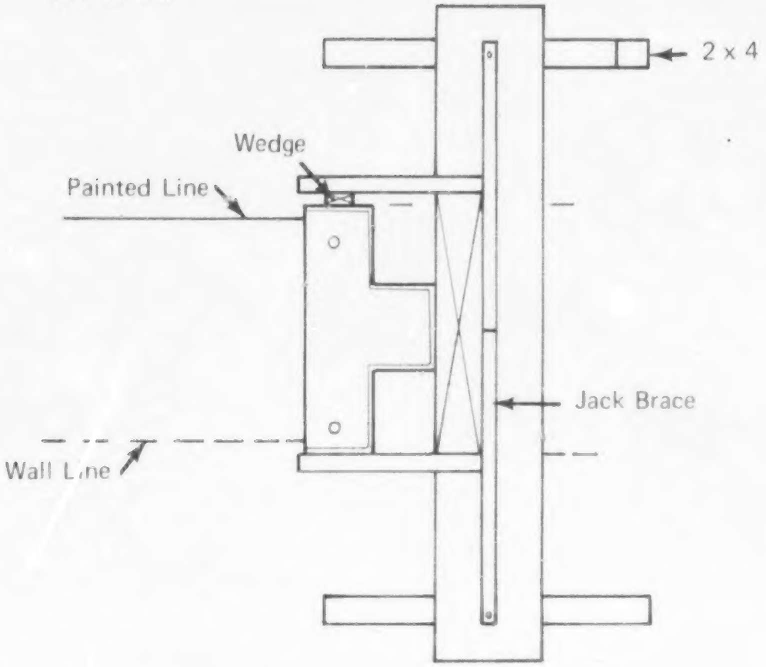


2. Stand buck upright at marks on floor

JOB SHEET #1

3. Place buck jack in position with ears on each side of buck (Figure 5)

FIGURE 5


2 x 4
Wedge
Painted Line
Jack Brace
Wall Line

4. Anchor bottom of door buck
   a. Line up buck in correct relationship to wall line
   b. Shoot two drive pins in bottom anchors

      (NOTE: If top of buck is not level, place shim under anchor plate before shooting drive pin.)

JOB SHEET #1

5. Insert wedges between ears on jack; bring buck to plumb position

6. Secure top brace (Figure 6)

   (NOTE: There are many methods of securing the top braces. The two methods are shown in Figures 6a and 6b.)

FIGURE 6a

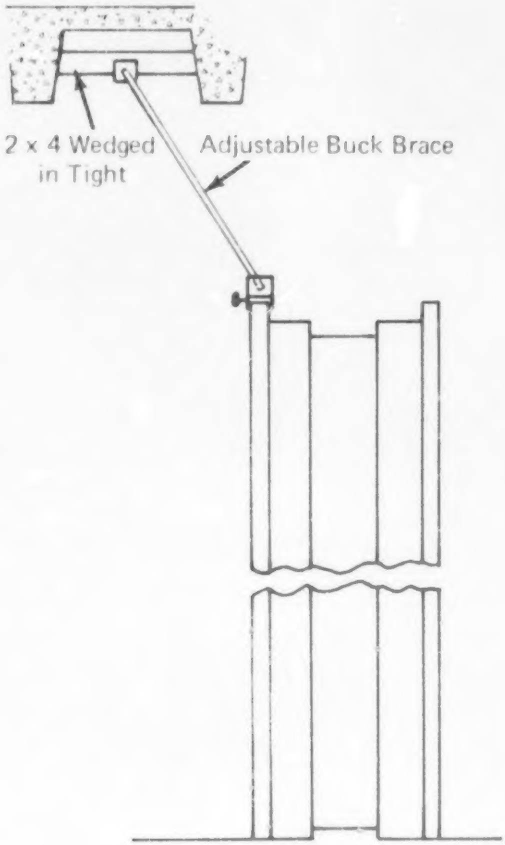
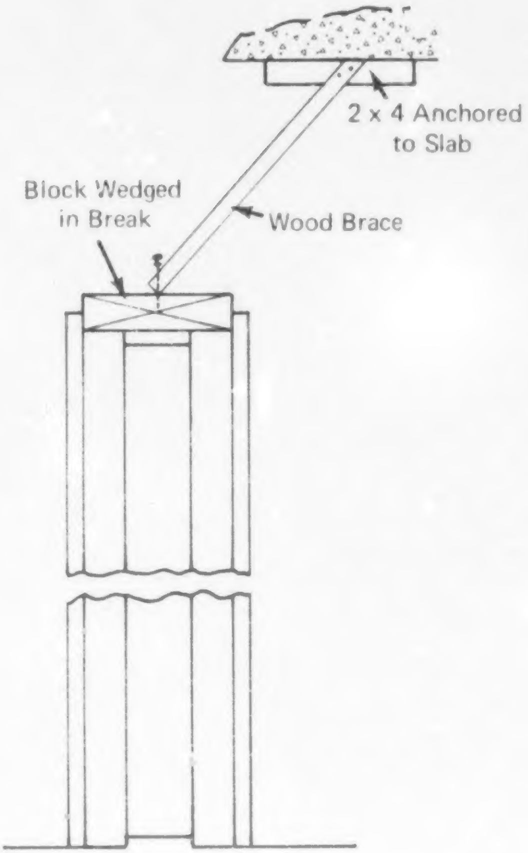

2 x 4 Wedged in Tight
Adjustable Buck Brace

FIGURE 6b


2 x 4 Anchored to Slab
Block Wedged in Break
Wood Brace

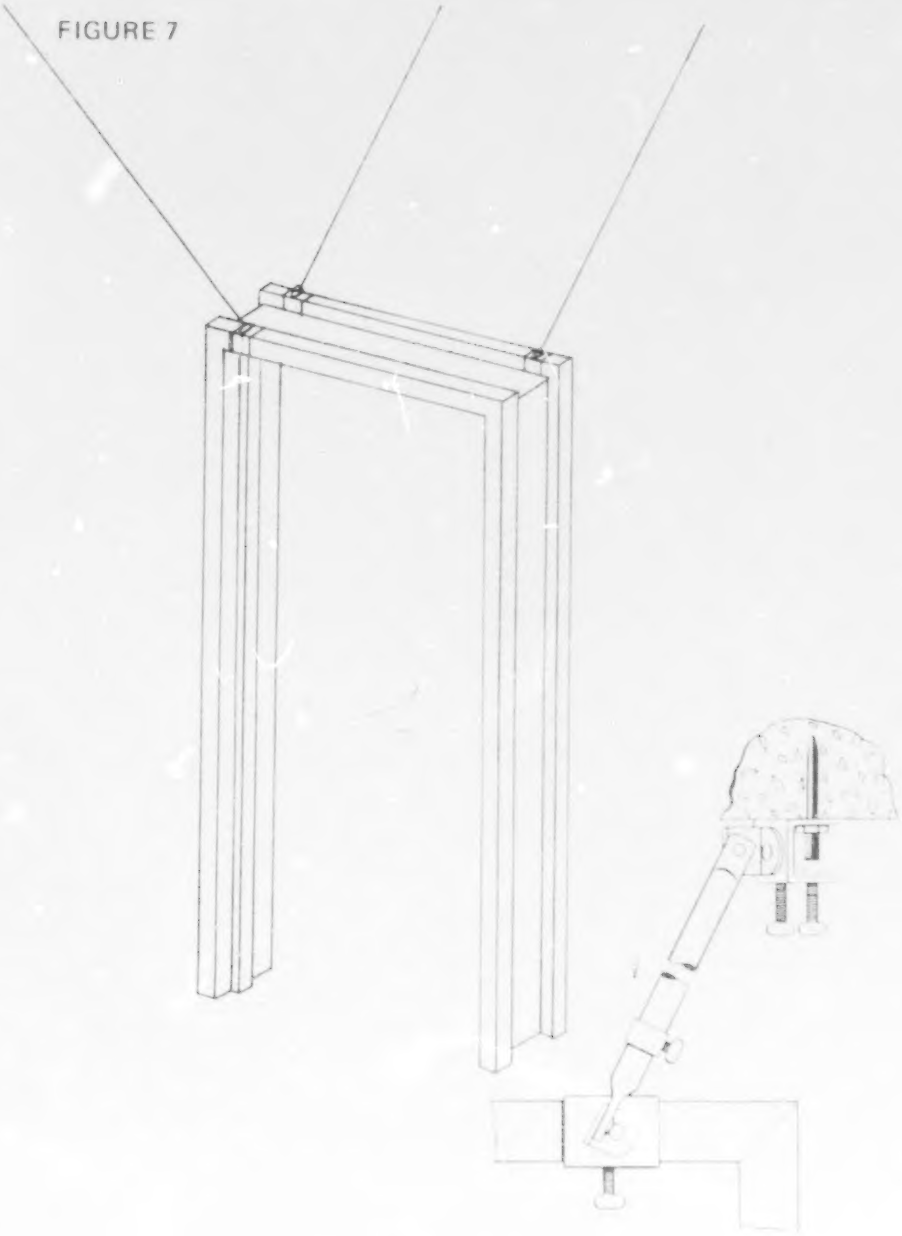
End View

JOB SHEET #1

7. Plumb opposite side and secure brace (Figure 7)

   (NOTE: Three braces are needed on the buck, two to hold the sides plumb to the wall line and one to hold it plumb to the length of the wall.)

FIGURE 7



FIREPROOF METAL STUD CONSTRUCTION
UNIT VI

JOB SHEET #2--INSTALL METAL STUDS

(NOTE: Layout and buck setting have been outlined in Job Sheet #1.)

I. Tools and materials

  A. Tools

    1. Measuring tape, 12 or 16 foot
    2. Hand level
    3. Claw hammer, 16 oz or larger
    4. Magnetic nail driver
    5. Drywall screw gun
    6. Stud cutter
    7. Crimper
    8. Plumb bob
    9. Chalk line

  B. Materials

    1. Studs
    2. Runners
    3. Metal door buck anchors
    4. Nails, 1/2" concrete
    5. Screws

II. Procedure

  A. Install runners

    1. Secure runners to floor

       (NOTE: Use 1/2" concrete nails and magnetic driver.)

    2. Plumb up from floor runner to locate ceiling runner

       (NOTE: Use plumb bob at ends of wall to establish marks on ceiling.)

JOB SHEET #2

3. Snap a chalk line between points
4. Lay out stud spacing on floor and ceiling runner
5. Secure ceiling runner to ceiling

   (CAUTION: Be sure stud layout is plumb over floor runner layout.)

B. Install studs

1. Cut studs to length

   (NOTE: Studs may be purchased precut.)

2. Install full length studs
   a. Stand stud in position at layout marks

      (NOTE: Studs should be set inside the floor and ceiling channel.)

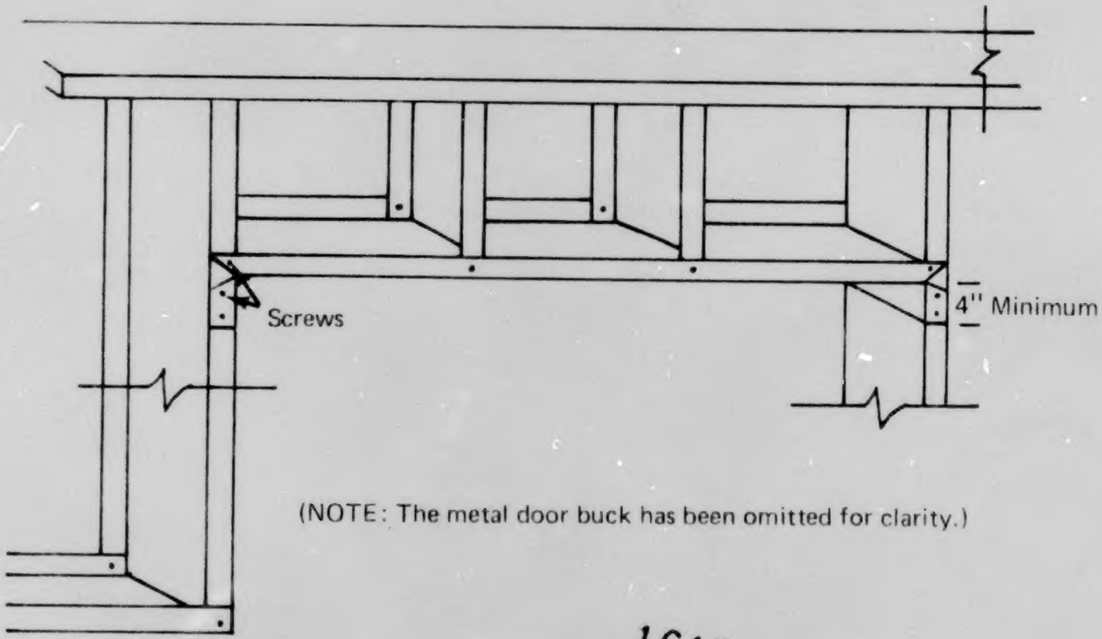
   b. Secure studs to floor and ceiling runners with crimping tool
   c. Place buck anchor in buck and secure stud to anchor

      (NOTE: Buck anchors should be placed approximately two feet on center.)

3. Install cripple studs at doors and windows (Figure 1)

   (NOTE: If wood jambs are used, screw two-inch material to studs for nailers. Be sure to check rough opening size.)

FIGURE 1



(NOTE: The metal door buck has been omitted for clarity.)

JOB SHEET #2

a. Cut runner eight inches longer than opening

b. Cut standing flanges of runners four inches from each end

c. Bend runner down at cuts (Figure 1)

d. Screw both ends of runner to studs

e. Cut cripple studs to length

f. Attach cripple studs to runners with crimping tool or screws

FIREPROOF METAL STUD CONSTRUCTION
UNIT VI

TEST

NAME ______________________________ SCORE ______________

1. Define *fireproof metal stud construction.*

____

____

____

____

2. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

_____a. Channel used to anchor the studs at floor and ceiling

_____b. Tool used to hold short concrete nails while they are being driven

_____c. Standards based upon a common unit of measure of four inches, known as a *module,* used as a base for the grid which is essential for dimensional coordination of two or more different materials

_____d. Hand-operated tool used to cut studs and runners on the job

_____e. Hand-operated tool used to attach studs to runners by crimping

_____f. Electric screwdriver with a special head

_____g. Type of fastener driven with a powder actuated tool

_____h. Manufactured product with a clamp on each end that is adjustable for length; a piece of wood

1. Sheetrock screwdriver
2. Cutter
3. Drive pin
4. Crimper
5. Buck brace
6. Runner
7. Modular dimensional standards
8. Magnetic driver

3. Name four fasteners used for metal stud construction.

   a. ______________________________

   b. ______________________________

   c. ______________________________

   d. ______________________________

4. Name the components of a metal stud system.

   a. ______________________________

   b. ______________________________

   c. ______________________________

5. Demonstrate the ability to:

   a. Lay out wall lines for steel studs and install metal door bucks.

   b. Install steel studs.

   (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

FIREPROOF METAL STUD CONSTRUCTION
UNIT VI

ANSWERS TO TEST

1. Method of construction in which the main units are masonry and all other components are of noncombustible material

2. a. 6
   b. 8
   c. 7
   d. 2
   e. 4
   f. 1
   g. 3
   h. 5

3. Any four of the following:
   a. Concrete nails
   b. Masonry nails
   c. Drive pins
   d. Toggle bolts
   e. Screws
      1) Gypsum panel to standard metal framing, 1" type S Bugle Head
      2) Metal studs to door jamb anchor clips, 3/8" type S-12 Pan Head
      3) Metal studs to door jamb anchor clips, 1/2" type S-12 Pan Head
      4) Standard metal studs to runners, 3/8" type S Pan Head

4. a. Studs
   b. Runners
   c. Metal door buck anchor clips

5. Performance skills evaluated to the satisfaction of the instructor

COMMERCIAL CARPENTRY

PROGRESS CHART

Section H-1
Framing

	UNIT I FLOOR AND SILL FRAMING					UNIT II WALL AND PARTITION FRAMING										UNIT III ROOF FRAMING				
	1	2	3	4	5	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
Job	UNIT TEST	Build Box Sill & Install Floor Joist	Install Bridging	Lay Subfloor	Install Floor Joists for Cantilever Floor	UNIT TEST	Material Estimating	Lay Out Wall & Partition Locations on Floor	Cut Studs, Trimmers, Cripples, & Headers to Length	Build Corners, T's, and Headers	Construct Wall Sections for Single-Story Structure	Install Sheathing	Lay Out & Install Ceiling Joists	Install Windows	Install Exterior Door Frame & Hang Door	UNIT TEST	Compute Rafter Length	Estimate Roof Framing Materials	Lay Out Rafter Locations on Plate & Ridge on Two-Foot Centers	
Student's Name																				
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

		85% Correct	1/4" of Square Diagonally; Joist 4' OC ± 1/8"	1" Deviation from Straight Line; Joist 4' OC ± 1/8"	No Greater Than 1/8" Deviation; Splices on Joists; Nails in Joists	1/4" of Square; Joist 16" OC ± 1/8"	85% Correct	To Satisfaction of Instructor	± 1/8" of Plan Location	± 1/8" of Exact Length	± 1/8" of Being Flush & Square	± 1/8" at Intervals of 4'	All Breaks & Nails on Studs with Staggered Joints	1/8" of Square Diagonally; Joist 4' OC ± 1/8"	Square & Plumb	Square & Plumb	85% Correct	To Satisfaction of Instructor	To Satisfaction of Instructor	4" OC ± 1/8"	
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					
18																					
19																					
20																					

COMMERCIAL CARPENTRY

PROGRESS CHART

Section H-2
Framing

Job	UNIT III ROOF FRAMING (Continued)			UNIT IV TRUSSES					UNIT V STRUCTURAL TIMBER CONSTRUCTION				UNIT VI FIREPROOF METAL STUD CONSTRUCTION						
	5	6	7	1	2	3	4	5	1	2	3	4	1	2	3	4	5	6	7
Student's Name	Lay Out, Cut, & Erect Rafters	Apply Roof sheathing	UNIT TEST	Erect Light Frame Trusses for Gable Roof				UNIT TEST				UNIT TEST	Lay Out Wall Lines for Steel Studs & Install Metal Door Bucks	Install Metal Studs					
1																			
2																			
3																			
4																			
5																			
6																			
7																			

Accuracy

	4' OC ± 1/8" of Flush with Top of Ridge No More Than 1/4" Gap at Heel of Birdsmouth; Crown Up ± 1/8" in Lengths of Tails, 1/8" of Plumb		Splices on Rafters ± 1/8" Variation at Gable and Nails into Rafters		85% Correct	1/8" of Plumb & Square				85% Correct				85% Correct	Wall Lines Within 1/4" of Plan Dimensions; Buck Square & Plumb	Within 1/4" of Line @ 10'; Studs Within 1/4" @ 4' Layout				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				

section I
Exterior finish

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the styles of a cornice, the parts of a cornice, types of cornice molding, and styles of siding. The student should also be able to build a horizontal box cornice, apply wood siding, and apply plywood siding. This knowledge will be evidenced by completion of assignment sheet, job sheets, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with exterior plywood siding and trim to the correct definitions.
2. Identify styles of cornice.
3. Identify the parts of a cornice.
4. Identify types of cornice molding.
5. Name types of exterior wall coverings.
6. Identify styles of siding.
7. Estimate the material needed for siding and trim.
8. Demonstrate the ability to:
    a. Build a horizontal box cornice.
    b. Apply wood siding.
    c. Apply plywood siding.

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Informaton sheet

   C. Transparency masters

      1. TM 1--Styles of Cornice

      2. TM 2--Parts of a Cornice

      3. TM 3--Types of Cornice Molding

      4. TM 4--Styles of Siding

      5. TM 5--Some Textures of Plywood Siding

   D. Assignment Sheet #1--Material Estimating

   E. Answers to assignment sheet

   F. Job sheets

      1. Job Sheet #1--Build a Horizontal Box Cornice

      2. Job Sheet #2--Apply Wood Siding

      3. Job Sheet #3--Apply Plywood Siding

   G. Test

   H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago, Illinois: American Technical Society, 1955.

B. Cooper, George H., and Badzinski, Stanley Jr. *Building and Construction Estimating*. New York: McGraw-Hill, 1971.

C. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry*. 3rd ed. Chicago, Illinois: American Technical Society, 1963.

D. Lair, E. A. *Carpentry for the Building Trades*. St. Louis, Missouri: McGraw-Hill, 1953.

E. Smith, Ronald C. *Principles and Practices of Light Construction*. Englewood Cliffs, New Jersey: Prentice Hall Inc., 1970.

F. Wagner, Willis H. *Modern Carpentry*. Homewood, Illinois: Goodheart-Willcox, 1969.

G. *Plywood Siding*. Tacoma, Washington: American Plywood Association, 1977.

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

INFORMATION SHEET

I. Terms and definitions

  A. Batten--Strip of wood placed across a surface to cover joints

  B. Barge board--Trim board or fascia at the gable end of a structure and attached directly to the barge rafter

  C. Boxed cornice--Method of closing in the eave to form a box type structure using the wall of the building, the roof, the fascia, and the plancier

  D. Brick molding--Molding for exterior window and door frames against which the finished brick is laid

  E. Fascia--Flat outside horizontal member of a cornice which is attached to the rafter tails

  F. Frieze--Trim member that forms a band around the top of the wall of a structure covering the joint where the wall meets the cornice

  G. Furring strip--Flat pieces of lumber used to build up an irregular framing to an even surface for the application of flooring, ceiling, or wall covering

  H. Lookouts--Short wooden framing members attached to a ledger board at the top of the wall and to the rafter tails for attachment of the plancier

  I. Lookout ledger--Usually a 1 x 4 band around a structure at the top of the wall to which the lookouts are attached

  J. Overhang--Projection of the roof of a structure beyond the wall

  K. Plancier--Underside of the cornice; sometimes called a *soffit*

II. Styles of cornice (Transparency 1)

  A. Horizontal box cornice

  B. Sloping box cornice

  C. Open cornice

III. Parts of a cornice (Transparency 2)

  A. Fascia

  B. Lookout

INFORMATION SHEET

- C. Lookout ledger
- D. Soffit mold or frieze
- E. Plancier or soffit
- F. Rafter
- G. Blocking

IV. Types of cornice molding (Transparency 3)

- A. Crown
- B. Cove
- C. Bed

V. Types of exterior wall coverings

- A. Horizontal siding
  - 1. Wood
  - 2. Composition board
  - 3. Aluminum
- B. Shingles
  - 1. Asbestos
  - 2. Wood
  - 3. Insulated
- C. Verticle grooved panels
  - 1. Plywood
  - 2. Composition board
- D. Boards and battens
- E. Masonry
  - 1. Brick veneer
  - 2. Rock veneer
  - 3. Stucco

INFORMATION SHEET

VI. Styles of siding (Transparencies 4 and 5)

- A. Bevel siding (lap siding)
- B. Plywood siding
- C. Drop siding (shiplapped)
- D. Drop siding (tongue-and-grooved)

VII. Material estimating

- A. Cornice
  - 1. Gable roof
    - a. Determine the type of wall covering to be used from the specifications
    - b. Determine the style of cornice to be used from the specifications
    - c. Determine the running feet of fascia needed for the eave and for the barge

      (NOTE: The fascia must be wide enough to project at least one-half inch below the plancier.)
    - d. Determine the running feet of one by four lumber needed for the lookout ledger

      (NOTE: The lookout ledger must extend to the outside of the barge rafter at both ends of the building for attachment of the end lookouts.)
    - e. Determine the length and number of lookouts needed for two-foot centers

      (NOTE: Lookouts need to extend from barge to barge on both sides of the building.)
    - f. Determine the number of sheets of plywood needed for the plancier

      (NOTE: The area in square feet under the eave and rake divided by thirty-two equals the number of sheets.)
    - g. Determine the lineal feet of frieze needed

      (NOTE: Cover all areas where the plancier meets the vertical wall covering of the building.)

INFORMATION SHEET

2. Hip roof

   a. Determine the type of wall covering to be used from the specifications

   b. Determine the style of cornice to be used from the specifications

   c. Determine the running feet of fascia needed around the perimeter of the roof

      (NOTE: The fascia must be wide enough to cover the false fascia and project at least one-half inch below the plancier.)

   d. Determine the running feet of one by four lumber needed for the lookout ledger

   e. Determine the length and number of lookouts needed for two-foot centers

   f. Determine the number of sheets of plywood needed for the plancier

      (NOTE: The area in square feet under the eave divided by thirty-two equals the number of sheets.)

B. Siding

1. Determine the type of siding to be used from the specifications

2. Determine the wall area to be covered

   (NOTE: Disregard door and window openings. Siding is generally purchased by the square foot.)

3. From the table below add the necessary percentage for overlap and waste

Allowances for Overlap and Waste on Siding

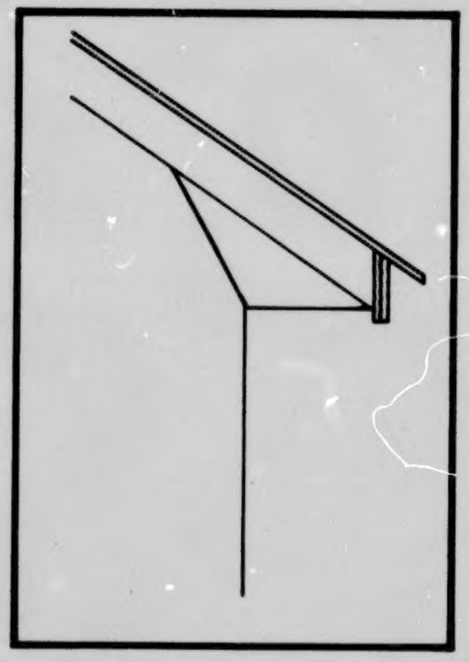
Siding	Nominal Width, In.	Percentage Added to Wall Area
Bevel	6 8 10 12	40 25 20 15
Tongued and Grooved	6 8 10	20 15 10

INFORMATION SHEET

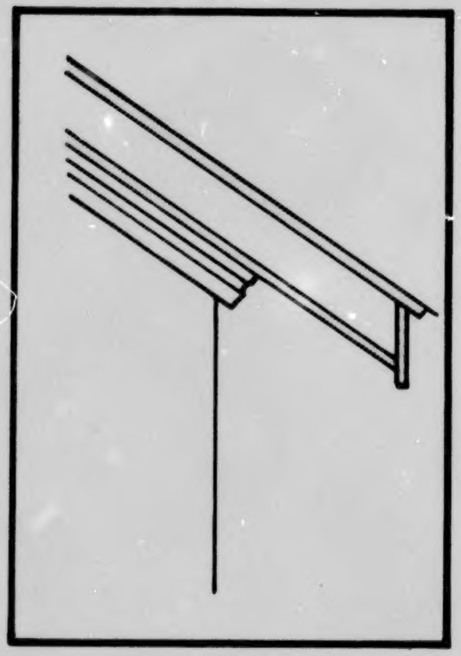
C. Nails required for exterior wall coverings and trim

Amount of Nails Required	
Cornice Work Siding	1 lb per 100 lin ft of Cornice Material
6d	6 lb per 1,000 sq ft
7d	6 1/2 lb per 1,000 sq ft
8d	9 lb per 1,000 sq ft
10d	11 lb per 1,000 sq ft

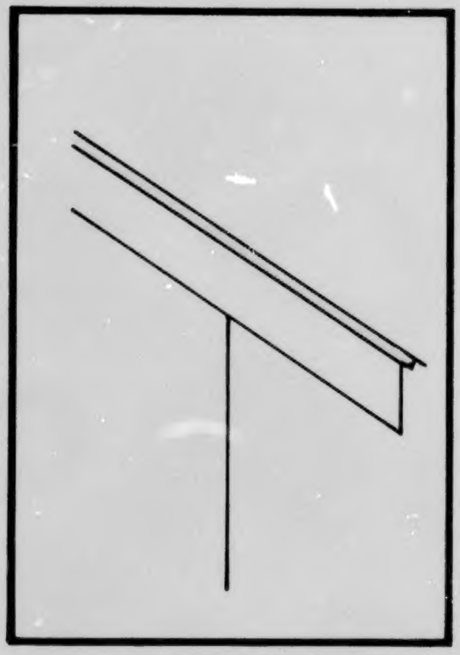
Styles of Cornice



HORIZONTAL BOX
CORNICE

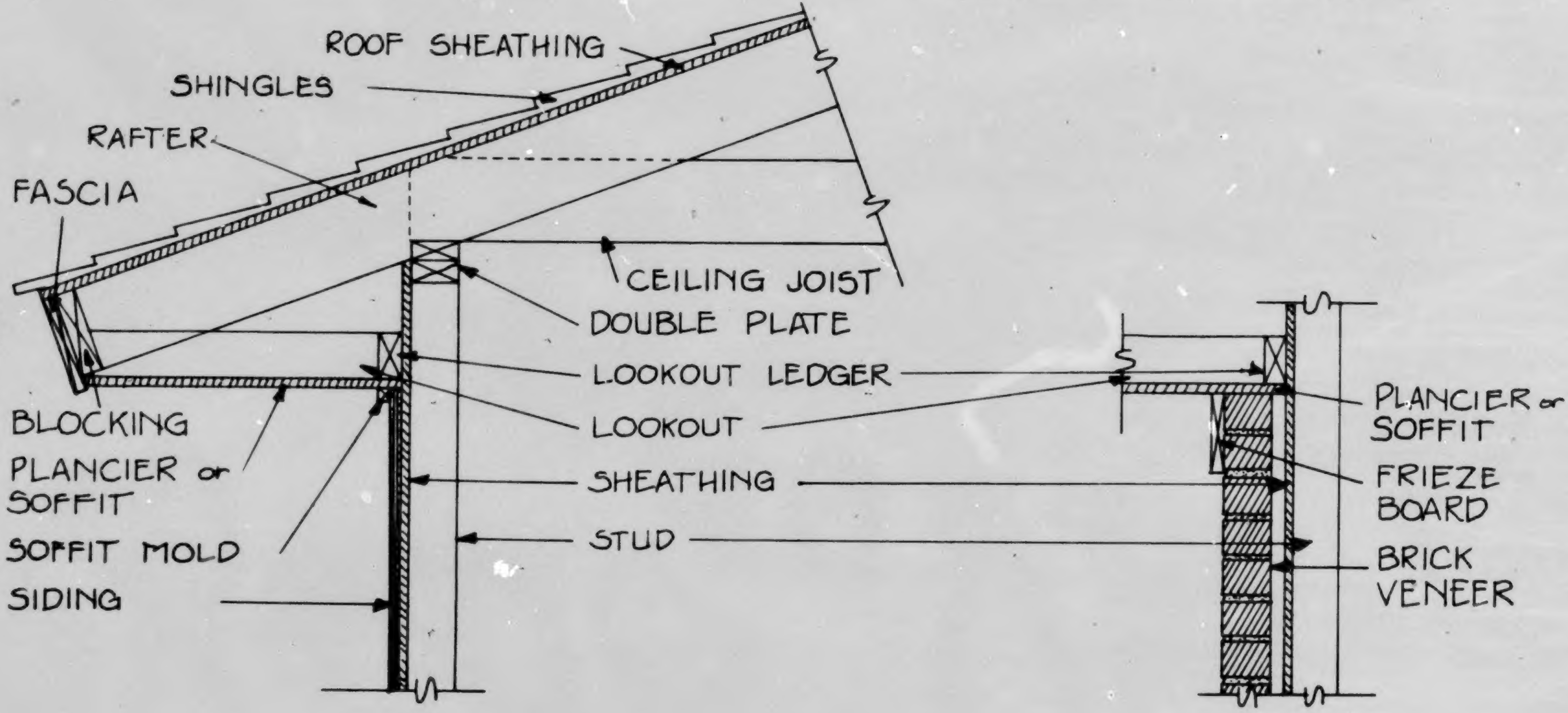


SLOPING BOX
CORNICE



OPEN CORNICE

Parts of a Cornice


ROOF SHEATHING
SHINGLES
RAFTER
FASCIA
BLOCKING
PLANCIER or SOFFIT
SOFFIT MOLD
SIDING
CEILING JOIST
DOUBLE PLATE
LOOKOUT LEDGER
LOOKOUT
SHEATHING
STUD
PLANCIER or SOFFIT
FRIEZE BOARD
BRICK VENEER

FOR SIDING

FOR BRICK VENEER

TM 2

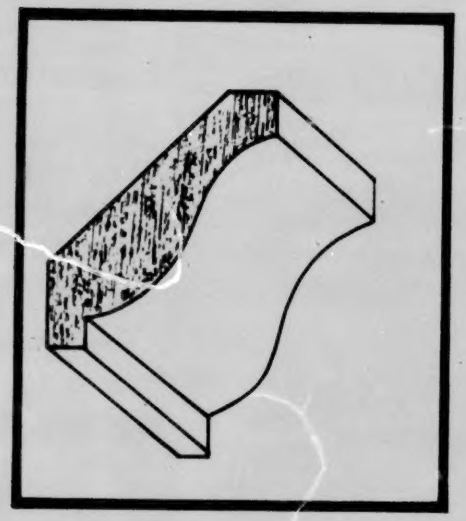
1641

SCALE 1" = 1'-0"

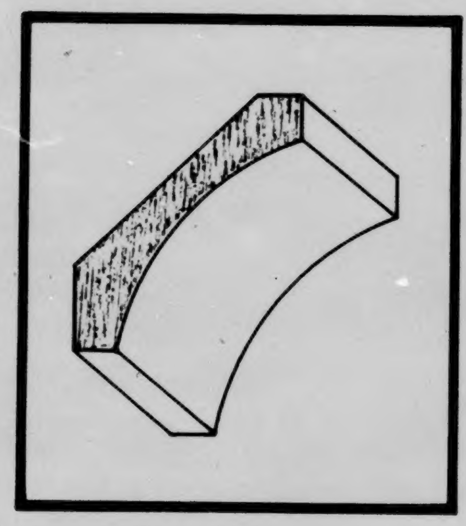
CC-13-

1642

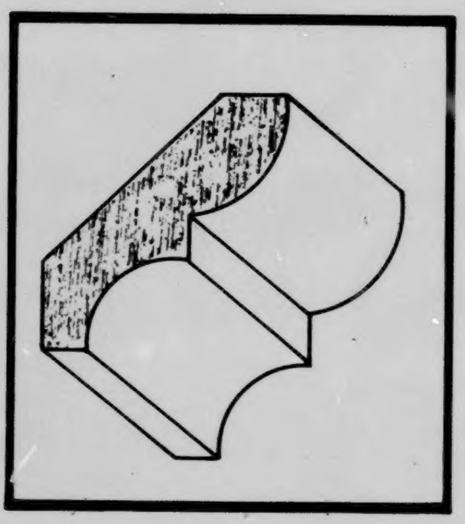
Types of Cornice Molding



CROWN MOLD

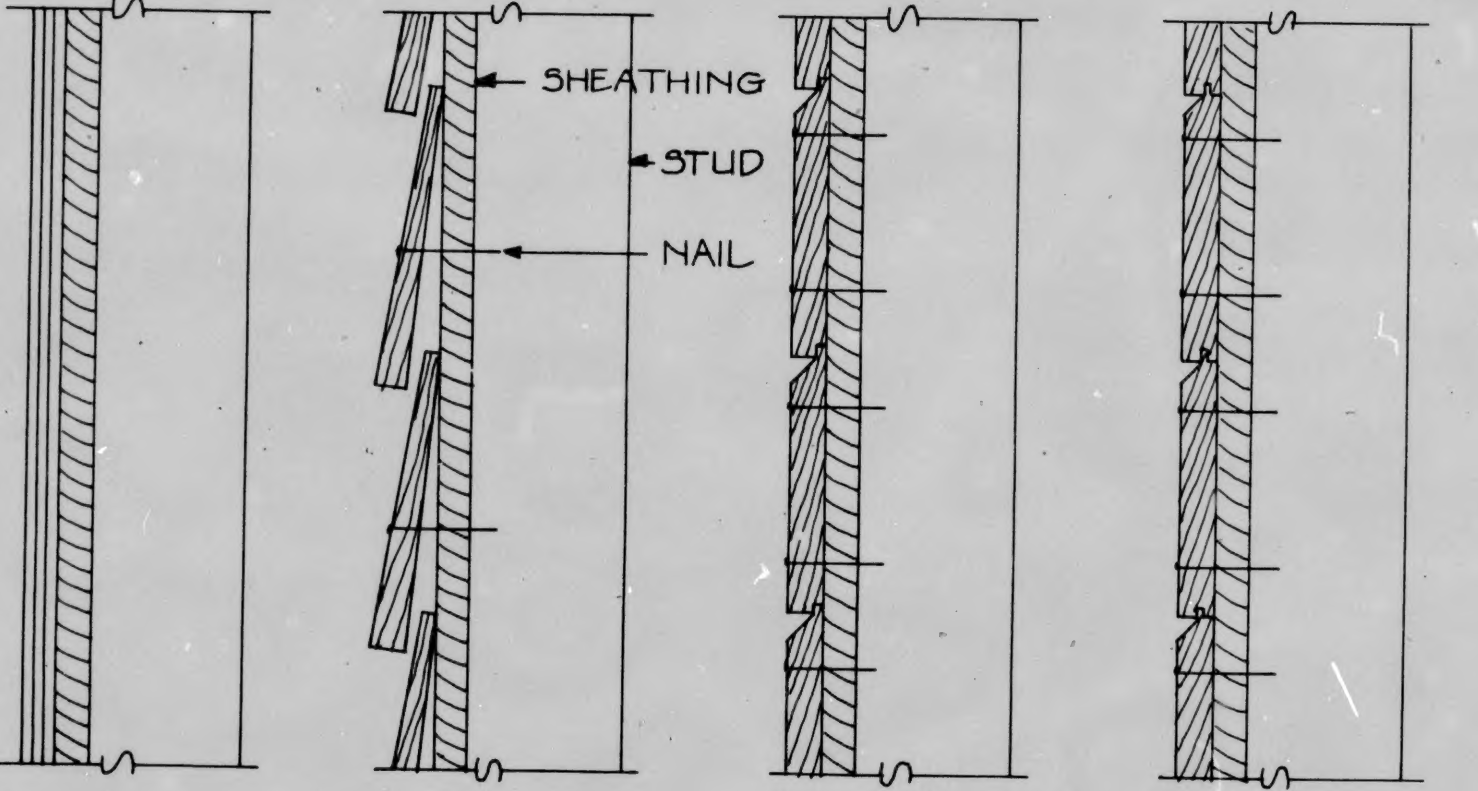


COVE MOLD



BED MOLD

Styles of Siding


SHEATHING
STUD
NAIL

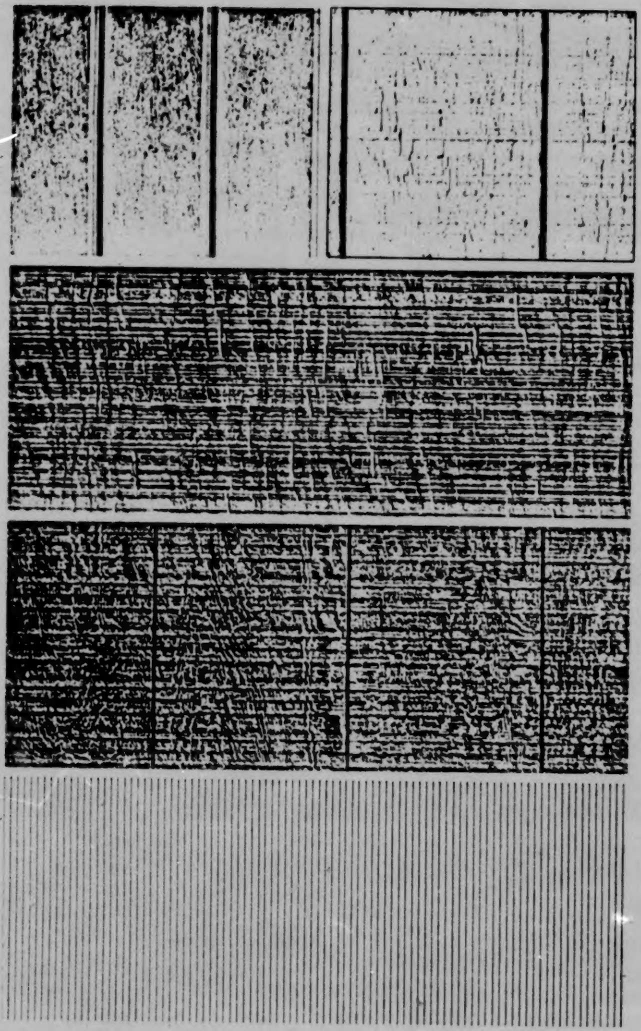
PLYWOOD SIDING

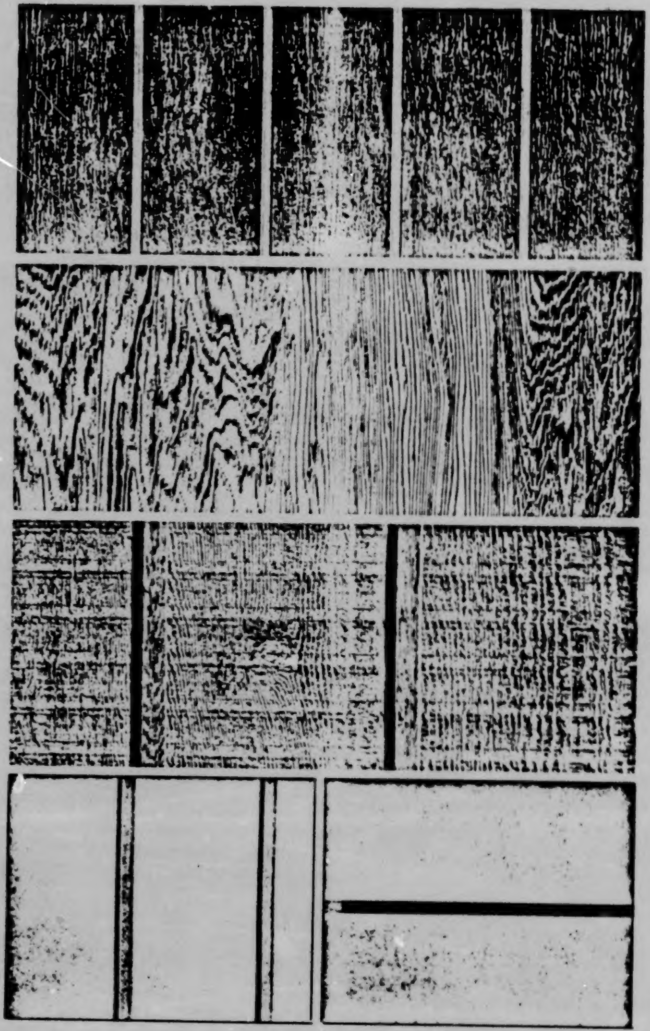
BEVEL SIDING
(Lap Siding)

DROP SIDING
(Shiplapped)

DROP SIDING
(Tongue-and-Grooved)

Some Textures of Plywood Siding





Courtesy American Plywood Association

TM 5

CC - 19

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

ASSIGNMENT SHEET #1--MATERIAL ESTIMATING

Using your information sheet, calculate the following materials for the building illustrated below.

______a. 2 x 4's for lookouts (lineal feet)

______b. 1 x 4's for lookout ledger (lineal feet)

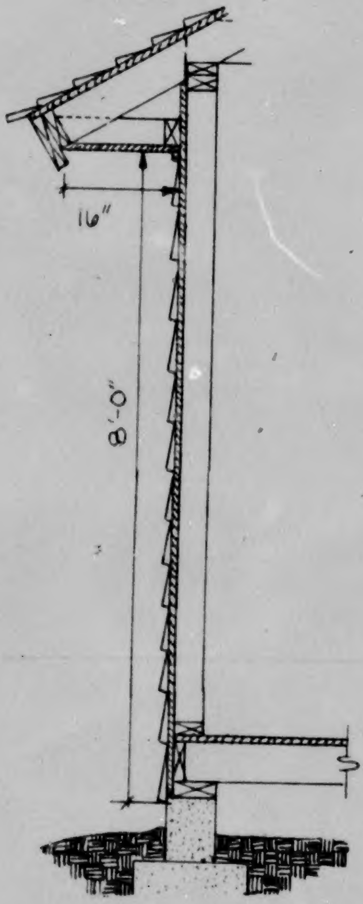
______c. Running feet of 1 x 8 fascia

______d. Sheets of 1/4" x 4' x 8' exterior Fir plywood for the plancier

______e. Square feet of 8" bevel siding needed

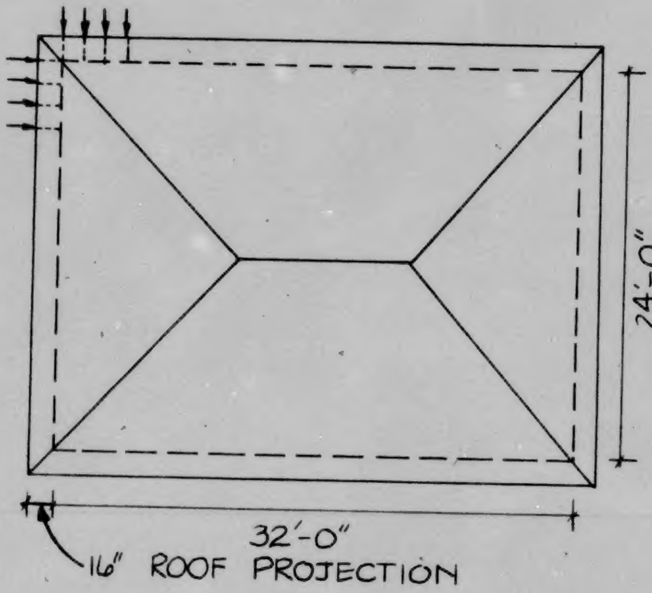
______f. Pounds of 8d box nails needed for siding

______g. Running feet of molding for frieze



SCALE: 1/2" = 1'-0"

LOOKOUT ARRANGEMENT WILL BE SAME AS RAFTER SPACING



SCALE: 3/32" = 1'-0"

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

ANSWERS TO ASSIGNMENT SHEET

a. 75

b. 112

c. 123

d. 5

e. 1120

f. 9

g. 112

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

JOB SHEET #1--BUILD A HORIZONTAL BOX CORNICE

I. Tools and materials

A. Tools

1. Radial arm or table saw
2. Framing square
3. Steel tape, 12 or 16 foot
4. Claw hammer, 16 oz or larger
5. Level, 4'
6. Crosscut handsaw
7. Chalk line and reel
8. Sawhorses
9. Planks to walk on

B. Materials

1. 2 x 4's for lookouts
2. 1 x 4's for lookout ledger
3. Plywood for plancier (soffit)
4. 1 x 8's for fascia
5. 1 x 2's for frieze
6. 4d box galvanized nails for plancier
7. 8d case galvanized nails for fascia
8. 8d box nails for lookout ledger
9. 16d box nails for lookouts

JOB SHEET #1

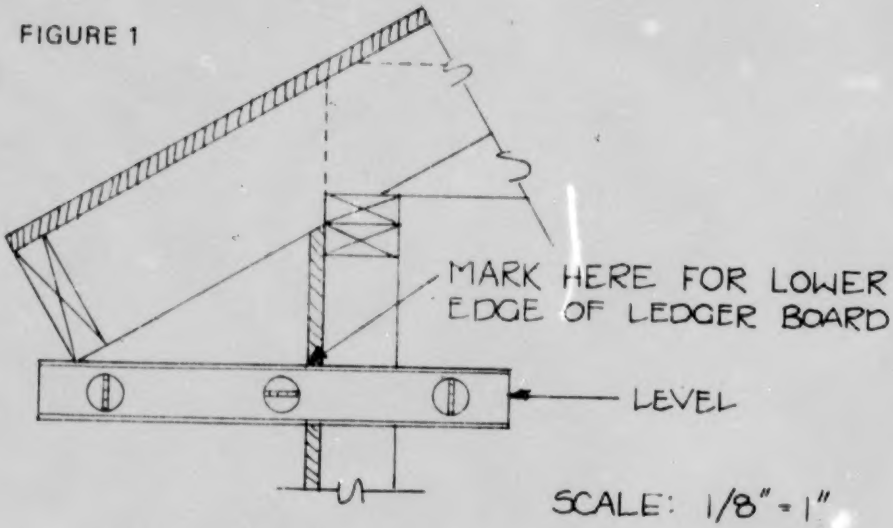
II. Procedure (Transparency 2)

A. Hip roof

1. Install the lookout ledger

   a. Locate the lower edge of the ledger level with the bottom of the false fascia (Figure 1)

FIGURE 1



   b. Repeat step a at each corner

   c. Snap a chalk line on each side of the building between the corner marks

   d. Install 1 x 4 ledger board forming a band completely around the structure

   (NOTE: Nail on each stud with 2 - 8d nails.)

   e. Mark the ledger board on twenty-four-inch centers to come out on the same side of each rafter

2. Cut and install lookouts

   a. Determine the length needed by measuring inside the lower edge of the false fascia to the outside of the ledger

   b. Determine the number needed

   c. Cut 2 x 4's to length using the radial arm or table saw

JOB SHEET #1

d. Install lookouts

1) Nail the outside ends to the sides of rafters with 2 - 16d box nails

2) Toe nail the inside ends to the ledger board with 3 - 8d box nails

(NOTE: Be sure to keep the outside end flush with bottom of the false fascia and the inside end flush with the bottom of the ledger.)

3. Cut and install the plancier (soffit)

a. Determine the width of the plancier

(NOTE: Most buildings require a sixteen- or twenty-four-inch plancier.)

b. Rip the plywood panels lengthwise into strips the width of the plancier

c. Mark the bottom of the false fascia at the center of each lookout

d. Mark on the sheathing in the midddle of each lookout directly under the ledger

(NOTE: These marks will help to locate the lookouts for nailing the plancier.)

e. Nail the plancier in place approximately every six inches

(NOTE: All splices must be on a lookout and the outside edge of the plancier must be flush with the outside edge of the false fascia.)

4. Install the fascia

a. Start at a corner

(NOTE: Miter all corners and splices in between.)

b. Nail fascia in place using two 8d galvanized nails spaced approximately every sixteen inches

(NOTE: The top of the fascia should touch the bottom side of the shingles and the lower edge should project below the plancier at least one-half inch.)

JOB SHEET #1

5. Install the frieze

   a. For wood siding

      1) Install siding before installing frieze

      2) Install the frieze in the corner formed where the plancier meets the siding

         (NOTE: Nail the frieze in place using 8d nails.)

   b. For brick veneer (common brick)

      (NOTE: The frieze may be made by ripping 1 3/4" strips of 1" lumber.)

      1) Measure five inches out from the sheathing on the plancier and make a mark at each corner of the building

         (NOTE: The spacing will vary with brick size.)

      2) Snap a chalk line between the marks on the bottom side of the plancier

         (NOTE: This line is the inside of the frieze and the outside of the brick.)

      3) Nail the frieze to the bottom of the plancier with one 16d nail into each lookout

         (NOTE: To keep from splitting the frieze, drill a hole through the frieze at each nail location.)

B. Gable roof

1. Install the lookout ledger

   a. Locate the lower edge of the ledger the same way as for the hip roof

   b. Install the 1 x 4 ledger board only on the sides of the building under the eave

      (NOTE: Run the ledger board past the ends of the building as far as the outer face of the barge rafter.)

   c. Mark the ledger board on twenty-four-inch centers to come out on the same side of each rafter

JOB SHEET #1

2. Cut and install lookouts

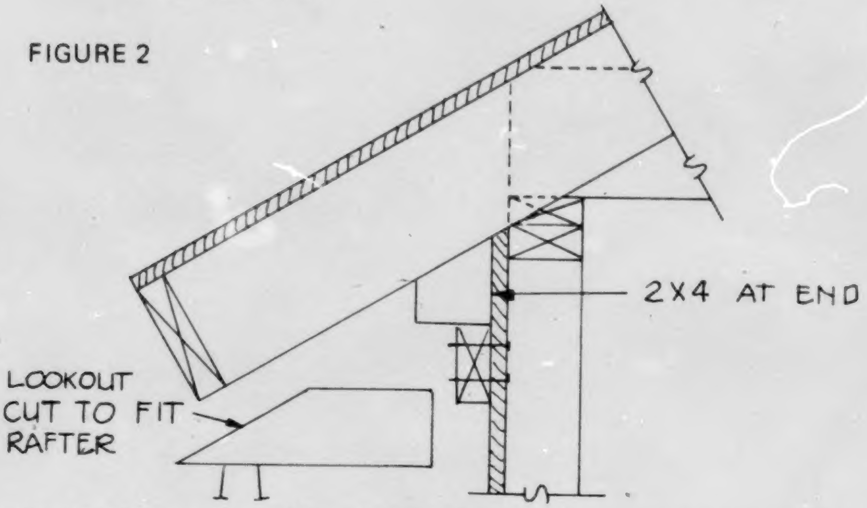
   a. Determine the length needed the same way as for a hip roof

   b. Determine the number needed

      (NOTE: Measure from the outside of one barge rafter to the outside of the opposite barge rafter in feet, divide by two, and add one for the end to get the number for one side. Double the number for the second side.)

   c. Cut the four end lookouts to fit bottom of the barge rafter and install (Figure 2)

FIGURE 2



LOOKOUT AT BARGE RAFTER SCALE 1/8"= 1"

   d. Install the remainder of the lookouts the same as for the hip roof

3. Cut and install the plancier

   a. Determine the width of the plancier

   b. Rip the plywood panels into strips the width of the plancier

      (NOTE: The plancier for the rake of the roof may be different than for the eave.)

   c. Mark the bottom of the false fascia at the center of each lookout

   d. Mark the sheathing in the middle of each lookout directly under the ledger board

      (NOTE: These marks will help locate the lookouts for nailing the plancier.)

JOB SHEET #1

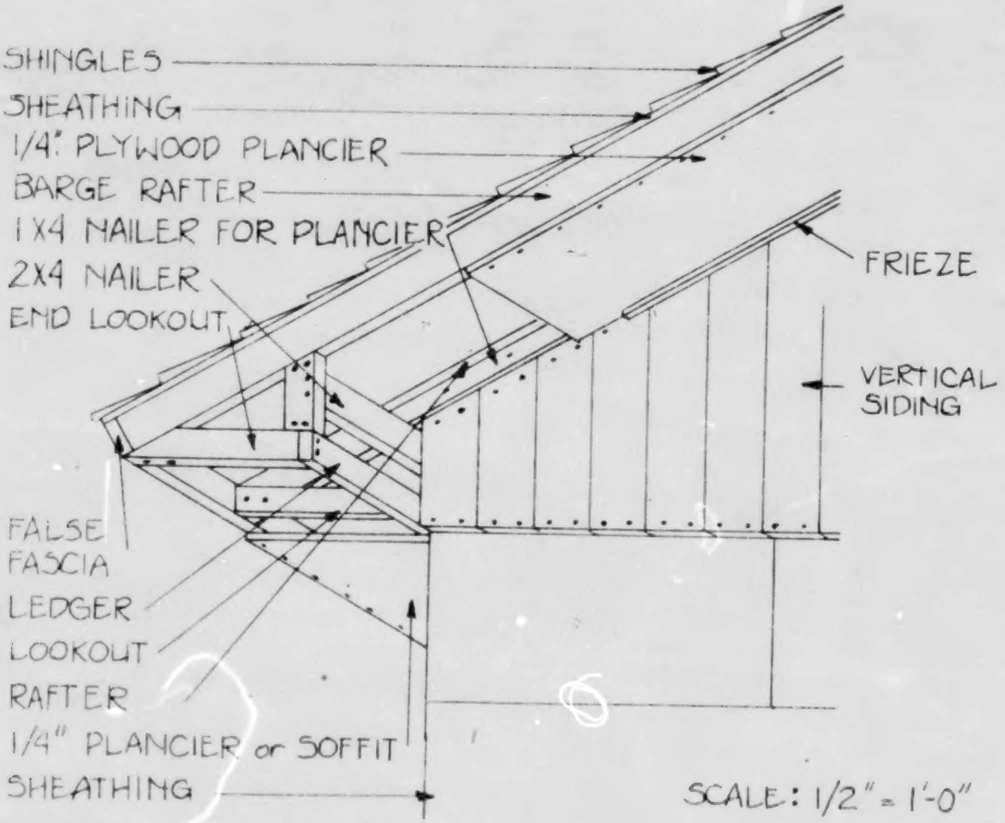
e. Nail the plancier in place at the gable ends

(NOTE: Start at the peak of the rake and work down both sides. The lower ends need only to extend past the outside of the sheathing.)

f. Nail the plancier in place under the eaves (Figure 3)

(NOTE: The plancier must be flush with the outside of the false fascia on the sides, flush with the outside face of the barge rafter on the ends, and flush with the outer face of the ledger where it projects past the end of the building.)

FIGURE 3


SHINGLES
SHEATHING
1/4" PLYWOOD PLANCIER
BARGE RAFTER
1X4 NAILER FOR PLANCIER
2X4 NAILER
END LOOKOUT
FRIEZE
VERTICAL SIDING
FALSE FASCIA
LEDGER
LOOKOUT
RAFTER
1/4" PLANCIER or SOFFIT
SHEATHING
SCALE: 1/2" = 1'-0"

JOB SHEET #1

4. Install the fascia

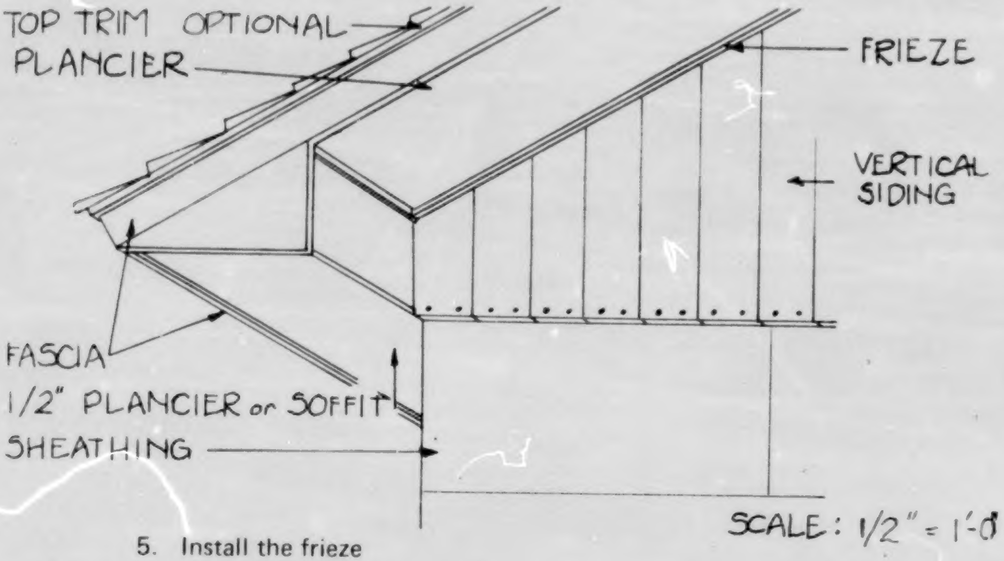
   a. Start at a corner

      (NOTE: Miter all corners and splices in between.)

   b. Nail fascia in place using two 8d galvanized nails approximately every sixteen inches (Figure 4)

      (NOTE: The top of the fascia should touch the bottom side of the shingles and the lower edge should project below the plancier at least one-half inch; an additional 1 x 2 trim board may be placed at the top of the fascia if desired.)

FIGURE 4


TOP TRIM OPTIONAL
PLANCIER
FRIEZE
VERTICAL SIDING
FASCIA
1/2" PLANCIER or SOFFIT
SHEATHING
SCALE: 1/2" = 1'-0"

5. Install the frieze

   a. For wood siding

      1) Install siding before installing frieze

      2) Install the frieze in the corner formed by the plancier meeting the siding

         (NOTE: Nail the frieze in place.)

   b. For brick veneer (common brick)

      (NOTE: The frieze may be made by ripping 1 3/4" strips from 1" lumber.)

      1) Measure five inches out from the sheathing on the plancier and make a mark at each corner of the building

         (NOTE: This will vary with different brick.)

JOB SHEET #1

2) Snap a chalk line between the marks on the bottom side of the plancier

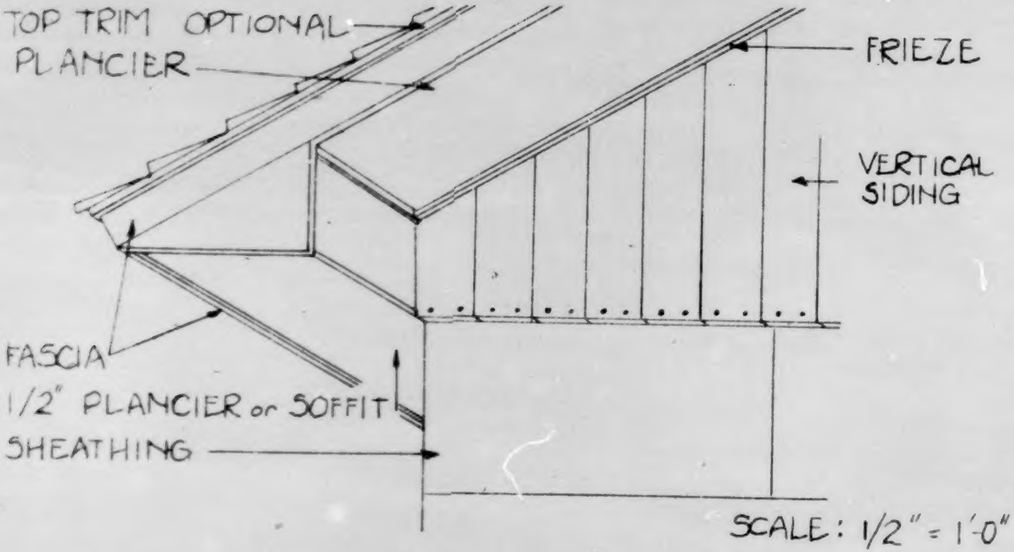
(NOTE: This line is the inside of the frieze and the outside of the brick.)

3) Nail the frieze to the bottom of the plancier with one 16d nail into each lookout

(NOTE: To keep from splitting the frieze, drill a hole through the frieze at each nail location. All splices should be on a lookout.)

6. Finish boxing in the end of the eave (Figure 5)

FIGURE 5


TOP TRIM OPTIONAL
PLANCIER
FRIEZE
VERTICAL SIDING
FASCIA
1/2" PLANCIER or SOFFIT
SHEATHING
SCALE: 1/2" = 1'-0"

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

JOB SHEET #2--APPLY WOOD SIDING

I. Tools and materials

A. Tools

1. Radial arm or table saw
2. Crosscut handsaw
3. Electric handsaw
4. Claw hammer, 16 oz or larger
5. Chalk line and reel
6. Steel tape, 12 or 16 foot
7. Sawhorses and planks
8. Framing square
9. Tri-square

B. Materials

1. Siding
2. Corner material
    a. Metal (inside and outside corners and nails)
    b. Lumber
3. Nails (as specified)

II. Procedure

(NOTE: All types of horizontal siding are installed basically the same except for the starter piece.)

A. Prepare structure to receive siding

B. Determine the method of fitting corners (Figures 1, 2, and 3)

(NOTE: The figures for this step are on the next page.)

JOB SHEET #2

Diagram of Corners

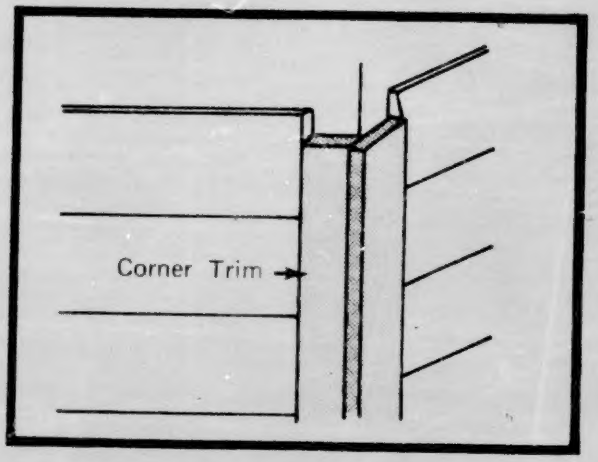

Corner Trim

FIGURE 1

Siding cut and fitted to corner trim at the corner of the wall.

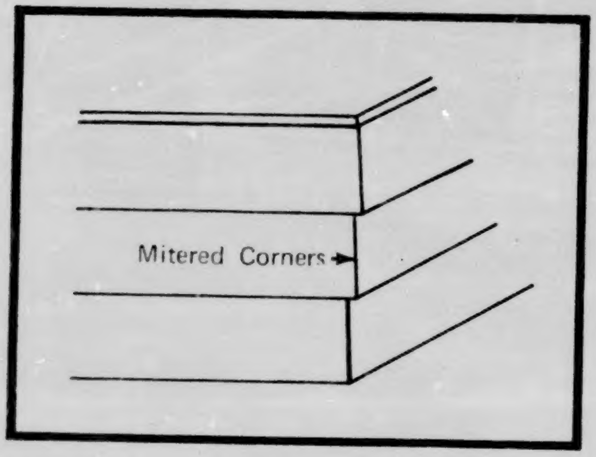

Mitered Corners

FIGURE 2

Siding boards mitered at the corners.

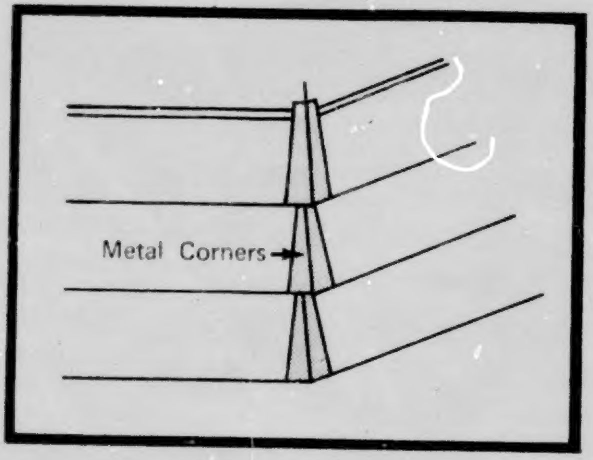

Metal Corners

FIGURE 3

Metal corners used to cover up the joints and to keep out moisture.

1660

JOB SHEET #2

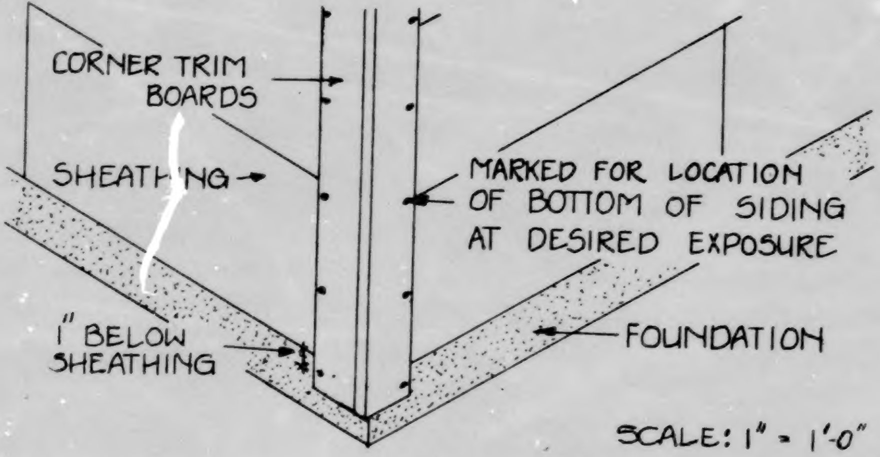
1. Install the inside and outside trim boards (Figure 1)
2. Inside corner trim consists of a 1 x 1 strip nailed into the corner for the ends of the siding to butt against
3. Use 2 - 1 x 4's for the outside corners (Figure 1)

   (NOTE: The bottom of the trim boards should extend one inch below the bottom course of sheathing.)

C. Determine the amount of exposure desired for lap siding

D. Lay off the locations for the bottom of each siding board on the corner boards (Figure 4)

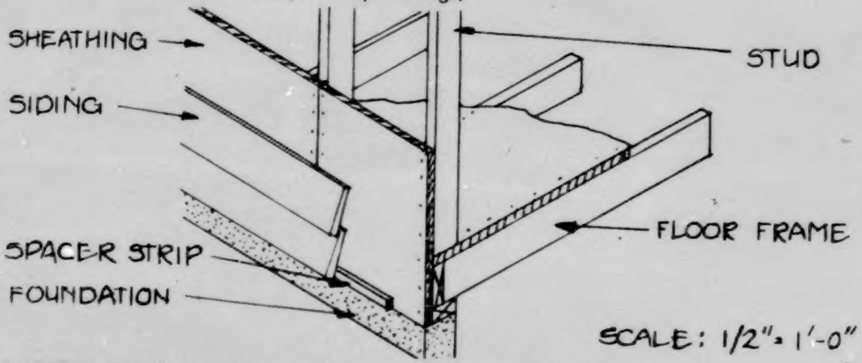
FIGURE 4


CORNER TRIM BOARDS
SHEATHING
MARKED FOR LOCATION OF BOTTOM OF SIDING AT DESIRED EXPOSURE
1" BELOW SHEATHING
FOUNDATION
SCALE: 1" = 1'-0"

E. Cut and nail a furring strip the thickness of the top edge of the lap siding being used to the bottom of the wall (Figure 5)

(NOTE: This is done only on lap siding.)

FIGURE 5


SHEATHING
SIDING
STUD
FLOOR FRAME
SPACER STRIP
FOUNDATION
SCALE: 1/2" = 1'-0"

(NOTE: Chalk a line at the point on the sheathing where the top of the spacer strip is to be in order to insure that the first course is straight.)

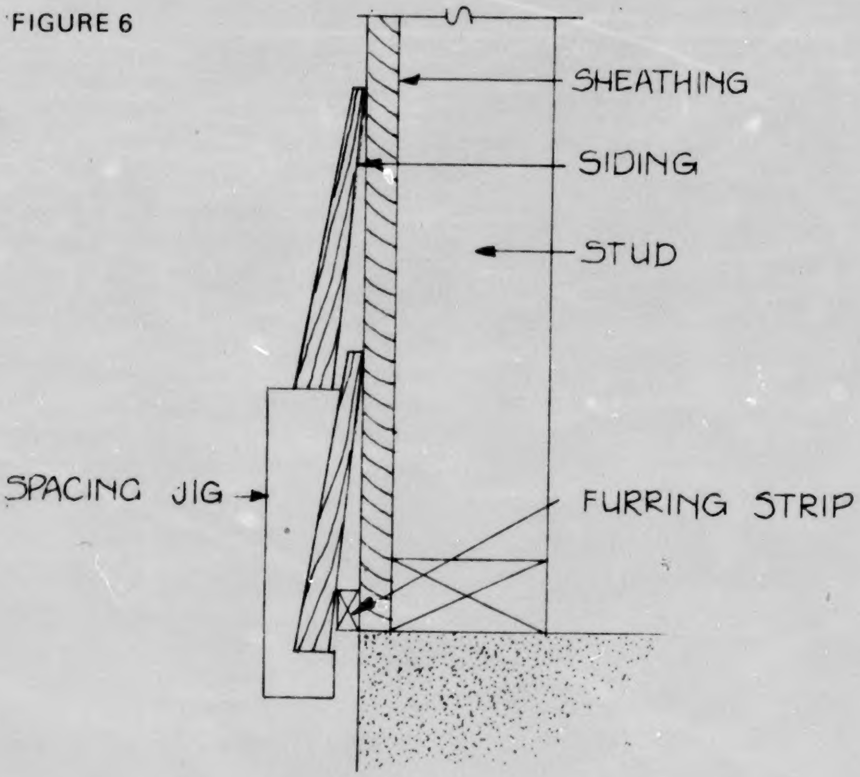
1661

JOB SHEET #2

F. Make a spacing jig for spacing siding in between corners (Figure 6)

(NOTE: See Figure 6 for a diagram of the "spacing jig" and how it is used.)

FIGURE 6


SHEATHING
SIDING
STUD
SPACING JIG
FURRING STRIP

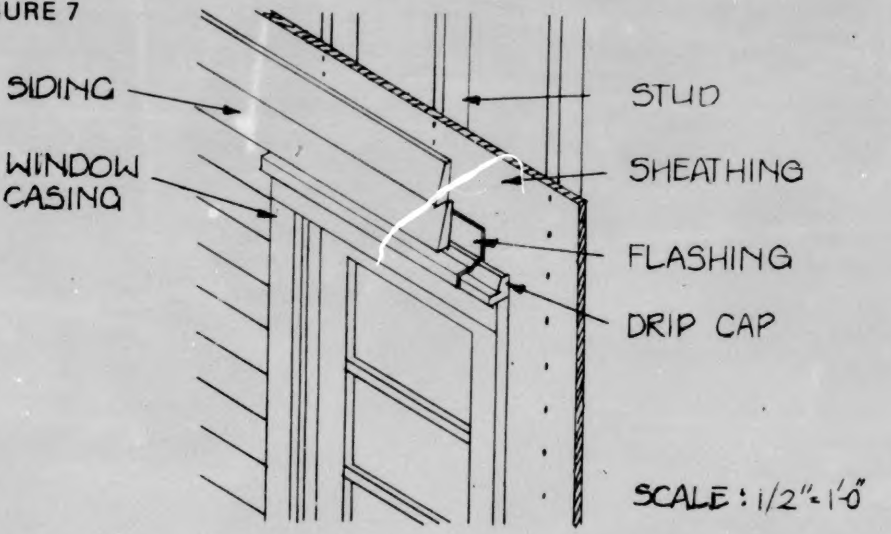
G. Install the remainder of the siding, working from the bottom up

(NOTE: All joints must fit tightly. All splices must be on a stud.)

JOB SHEET #2

H. Trim around windows and doors (Figure 7)

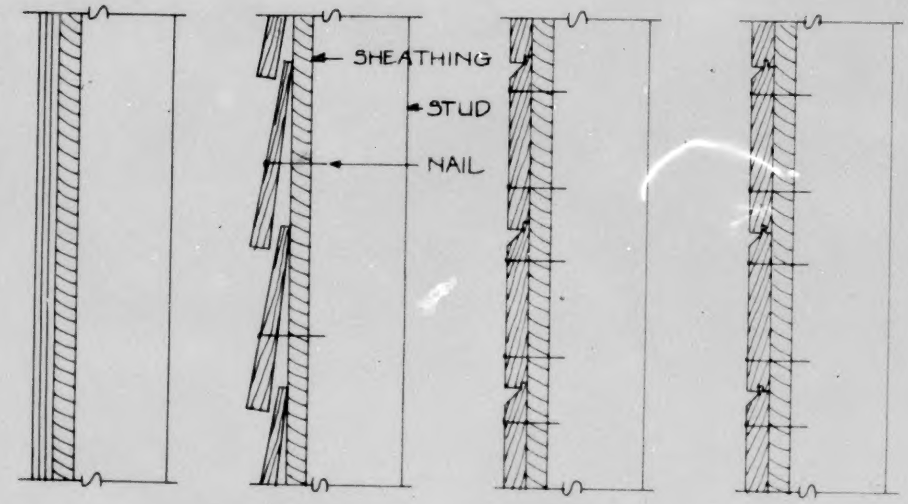
FIGURE 7


SIDING
WINDOW CASING
STUD
SHEATHING
FLASHING
DRIP CAP
SCALE: 1/2"=1'-0"

I. Caulk all joints around doors, windows, and at inside and outside corners (Figure 8)

J. Follow the nailing patterns for each style of siding

FIGURE 8


SHEATHING
STUD
NAIL

PLYWOOD SIDING **BEVEL SIDING (Lap Siding)** **DROP SIDING (Shiplapped)** **DROP SIDING (Tongue-and-Grooved)**

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

JOB SHEET #3--APPLY PLYWOOD SIDING

I. Tools and materials

  A. Tools

    1. Levels, 24" and 78"
    2. Framing square
    3. Claw hammer, 13 oz
    4. Tape, 12' or 16'
    5. Chalk line and reel
    6. Sawhorses
    7. Caulking gun
    8. Handsaw, 10 pt.
    9. Electric handsaw

  B. Materials

    1. Siding, 4' x 9'
    2. Corner material
      a. Metal corners (inside and outside)
      b. Wood
    3. Nails, 6d or 8d box or siding, galvanized or aluminum

       (NOTE: T-nail or staple may be used also.)
    4. Caulking
    5. Flashing material

II. Procedure

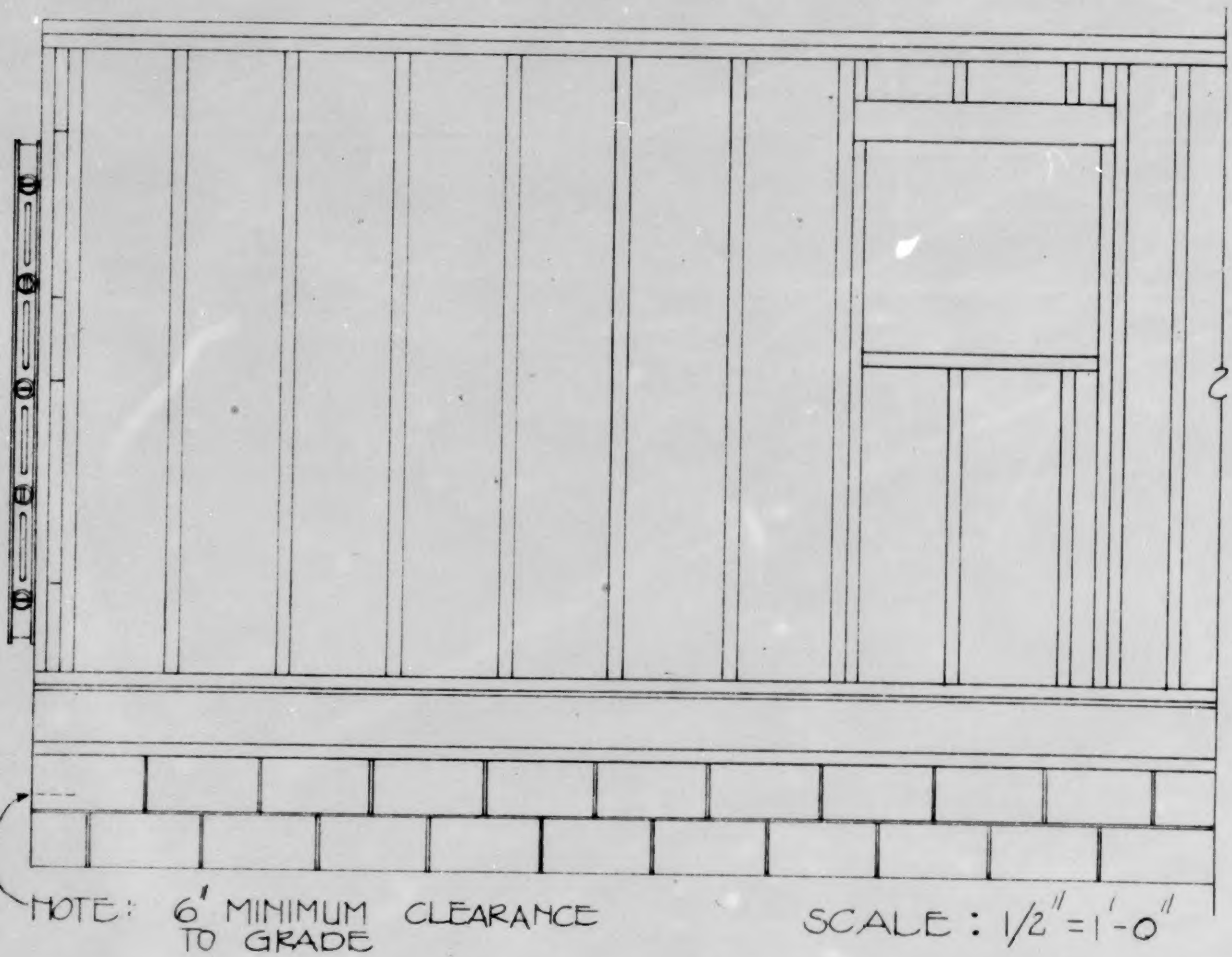
  A. Start at one corner

JOB SHEET #3

B. Check corner for plumb, as it may be necessary to scribe and cut first sheet of siding (Figure 1)

(NOTE: Whenever possible, cut siding from back side. If necessary to cut from finish side, protect finish by taping paper to underside of power saw.)

FIGURE 1

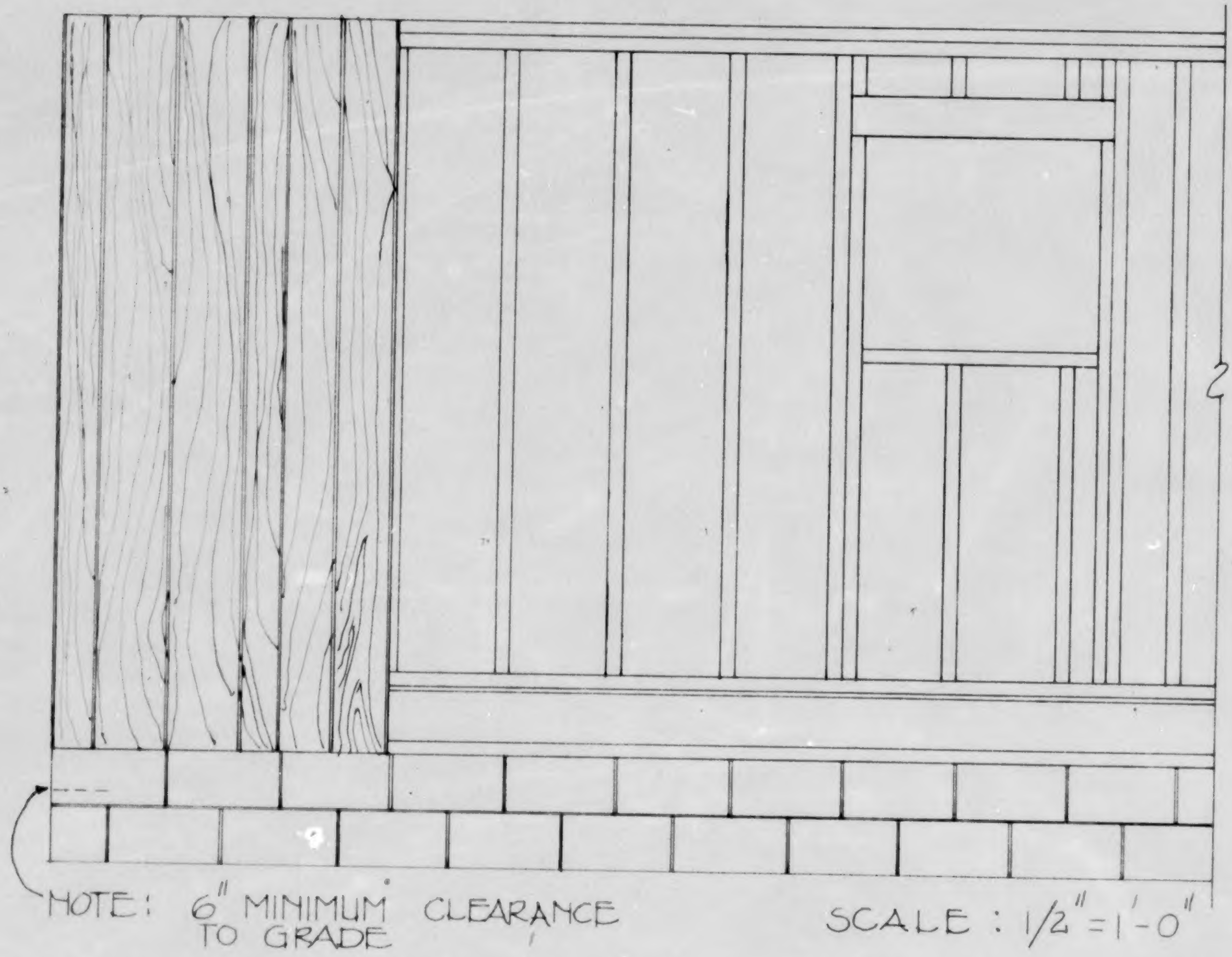

NOTE: 6' MINIMUM CLEARANCE TO GRADE
SCALE: 1/2" = 1'-0"

JOB SHEET #3

C. Nail up first sheet of siding, nailing edges every 6" and intermediate studs every 12"; use one nail per stud across top and bottom edges (Figure 2)

(NOTE: If corner materials are used, it may not be necessary to scribe and cut siding.)

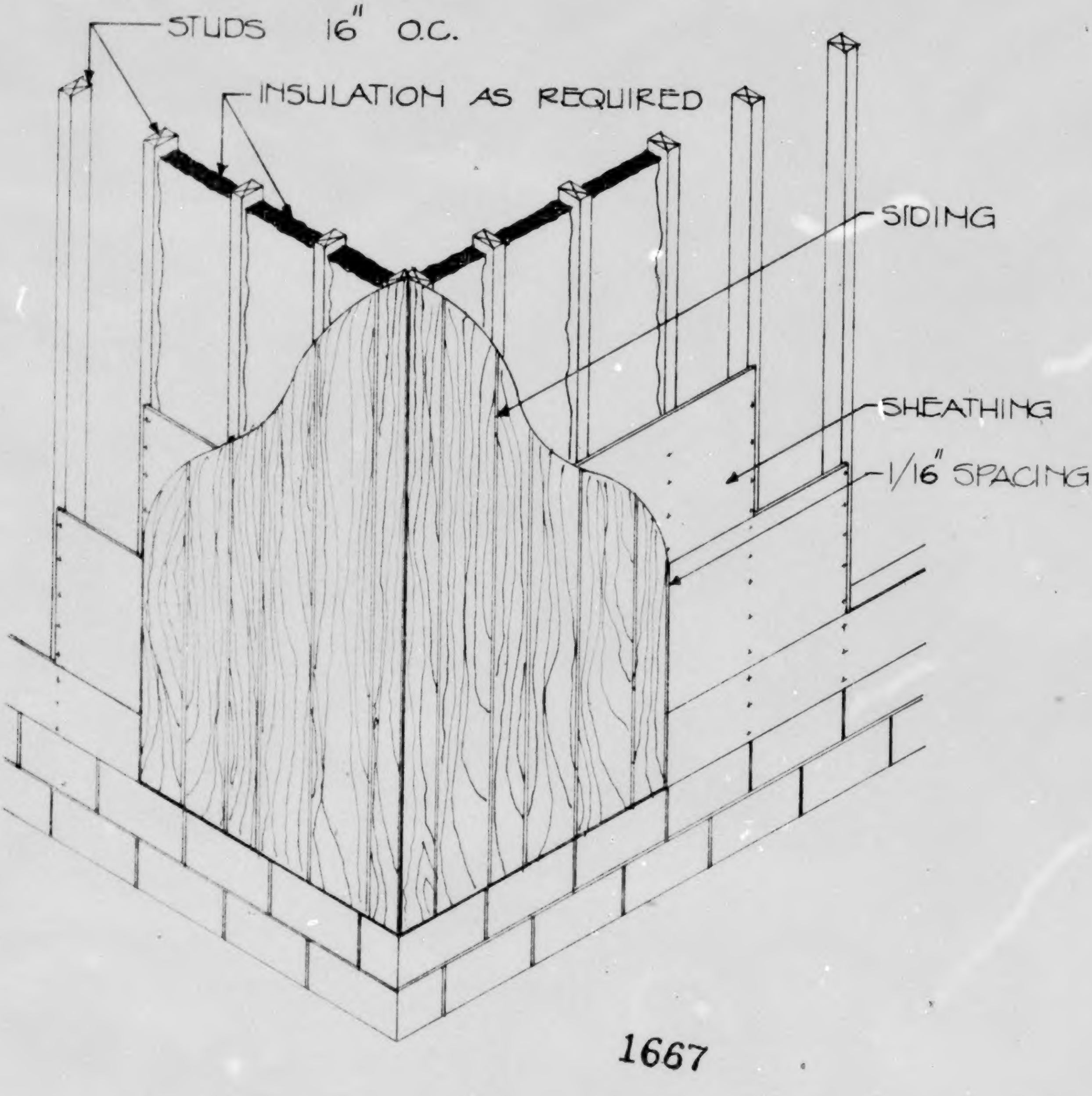
FIGURE 2


NOTE: 6" MINIMUM CLEARANCE TO GRADE
SCALE : 1/2" = 1'-0"

JOB SHEET #3

(NOTE: Leave 1/16" spacing at all edges and ends for shrinkage; also caulk all vertical joints and inside and outside corners. When installing horizontal siding, flashing and caulking should be used; Z flashing is recommended. Also, leave a slight gap around windows and doors for caulking. See Figure 3.)

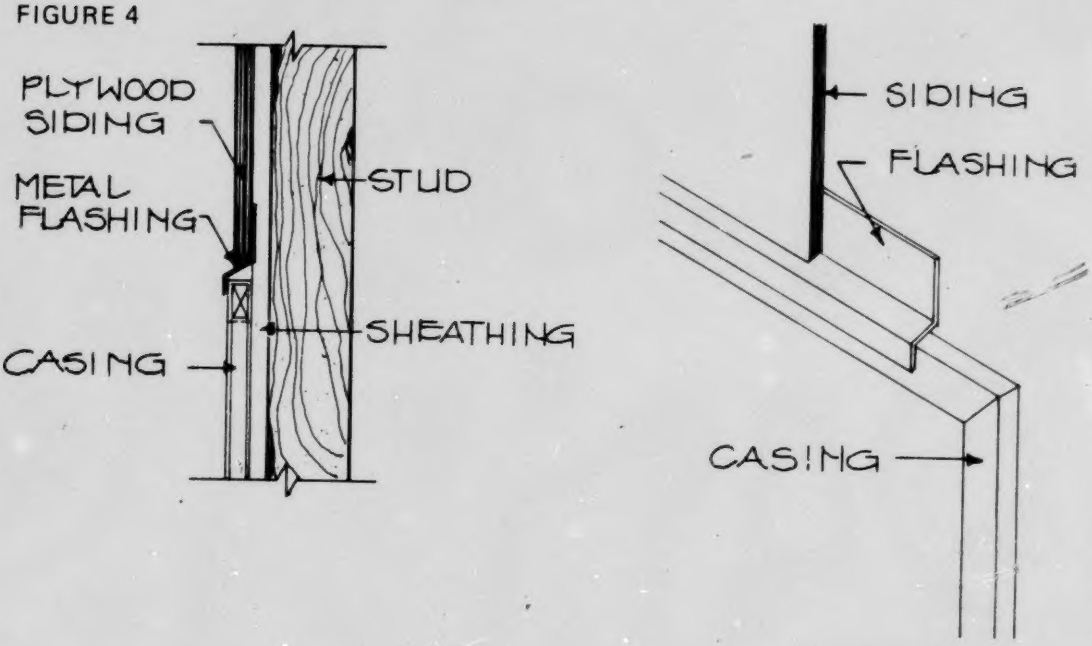
FIGURE 3


STUDS 16" O.C.
INSULATION AS REQUIRED
SIDING
SHEATHING
1/16" SPACING

JOB SHEET #3

D. Use caulking and flashing over windows and doors (Figure 4)

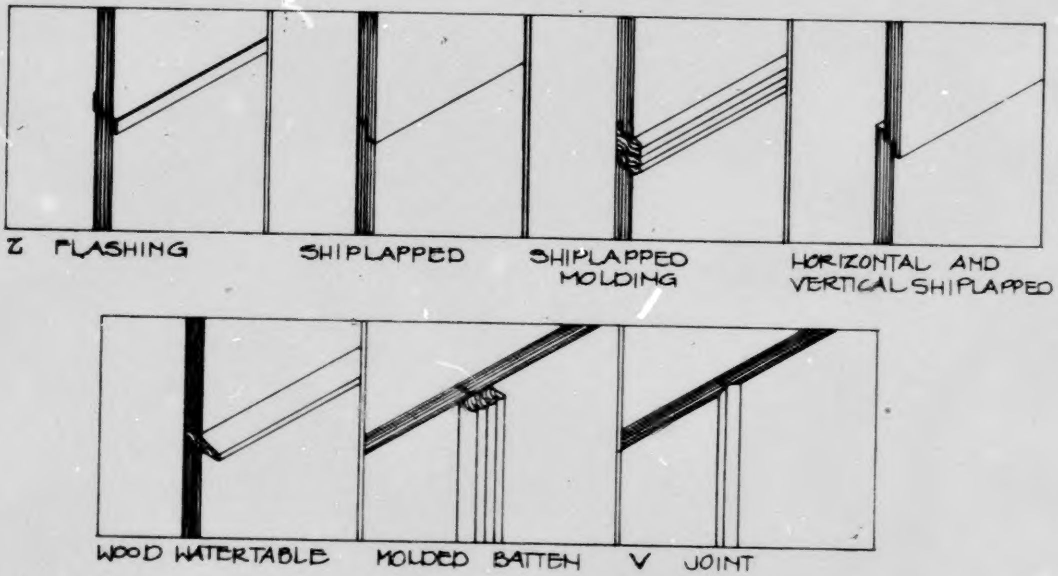
FIGURE 4


PLYWOOD SIDING
METAL FLASHING
STUD
SHEATHING
CASING
SIDING
FLASHING
CASING

E. Continue fitting and nailing siding

(NOTE: There are several joint details and methods of installation. See Figure 5.)

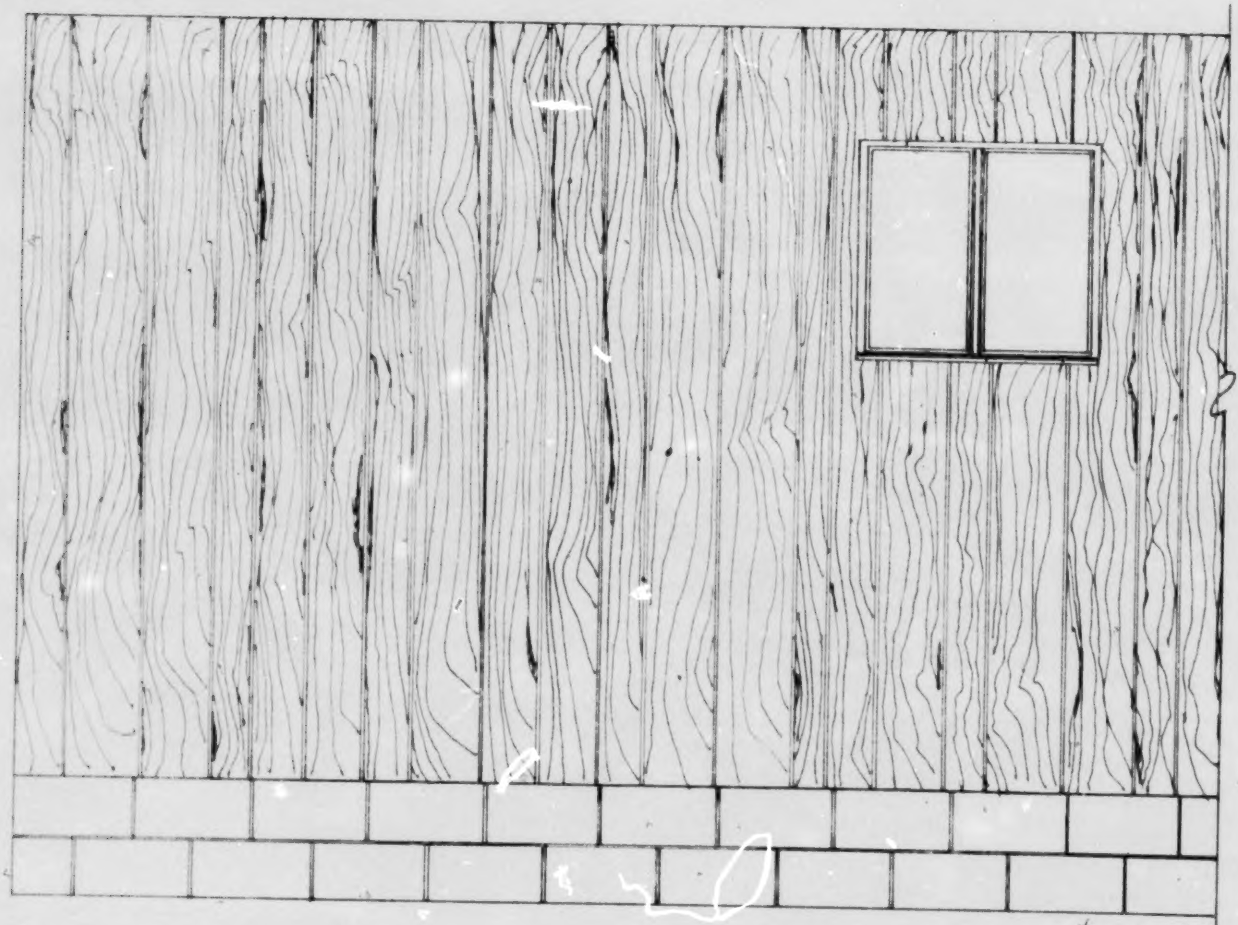
FIGURE 5


Z FLASHING
SHIPLAPPED
SHIPLAPPED MOLDING
HORIZONTAL AND VERTICAL SHIPLAPPED
WOOD WATERTABLE
MOLDED BATTEN
V JOINT

JOB SHEET #3

F. Continue fitting and nailing until side is done (Figure 6)

FIGURE 6



SCALE: 1/2" = 1'-0"

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

TEST

NAME ______________________________ SCORE ____________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Strip of wood placed across a surface to cover joints

______b. Method of closing in the eave to form a box type structure using the wall of the building, the roof, the fascia, and the plancier

______c. Molding for exterior window and door frames against which the finished brick is laid

______d. Flat outside horizontal member of a cornice which is attached to the rafter tails

______e. Trim member that forms a band around the top of the wall of a structure covering the joint where the wall meets the cornice

______f. Flat pieces of lumber used to build up an irregular framing to an even surface for the application of flooring, ceiling, or wall covering

______g. Short wooden framing members attached to a ledger board at the top of the wall and to the rafter tails for attachment of the plancier

______h. Usually a 1 x 4 band around a structure at the top of the wall to which the lookouts are attached

______i. Projection of the roof of a structure beyond the wall

______j. Underside of the cornice; sometimes called a *soffit*

______k. Trim board or fascia at the gable end of a structure and attached directly to the barge rafter

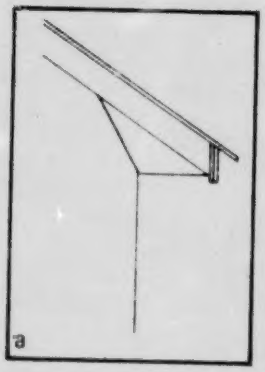
1. Fascia
2. Furring strip
3. Boxed cornice
4. Lookout ledger
5. Plancier
6. Batten
7. Brick molding
8. Frieze
9. Lookouts
10. Overhang
11. Barge board

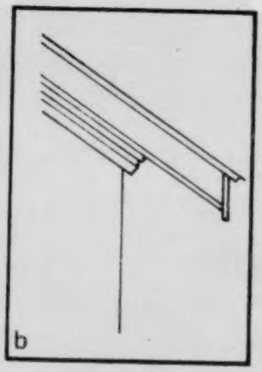
2. Identify the types of cornices pictured below.

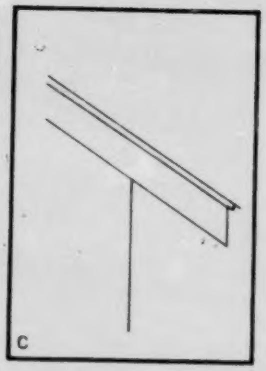
a. ______________________________

b. ______________________________

c. ______________________________







3. Identify the parts of the cornice pictured below.

a. ______________________________

b. ______________________________

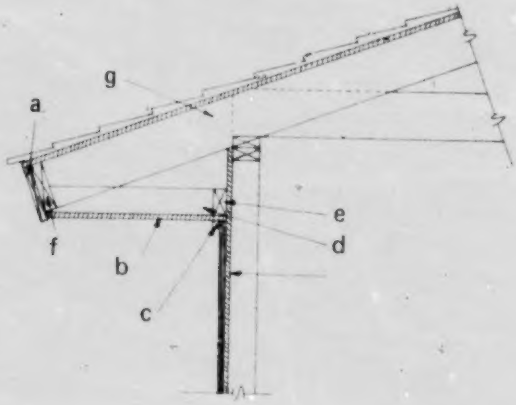
c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

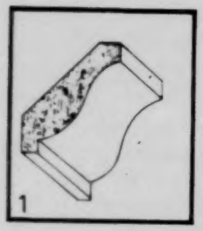


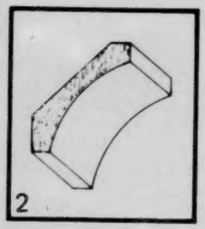
4. Identify the types of cornice molding pictured below by writing the correct numbers in the blanks provided.

______a. Bed mould

______b. Crown mould

______c. Cove mold


1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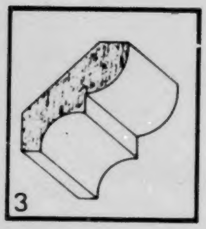

3

5. Name five types of exterior wall coverings.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

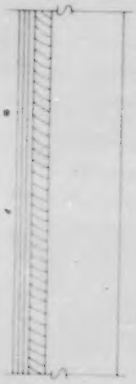
6. Identify the styles of siding pictured below.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________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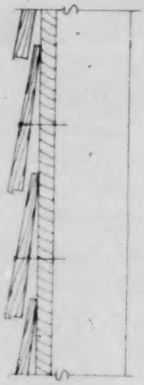
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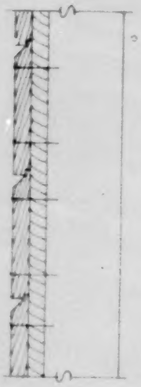
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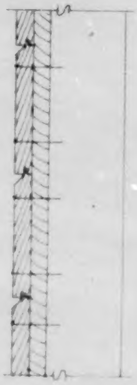
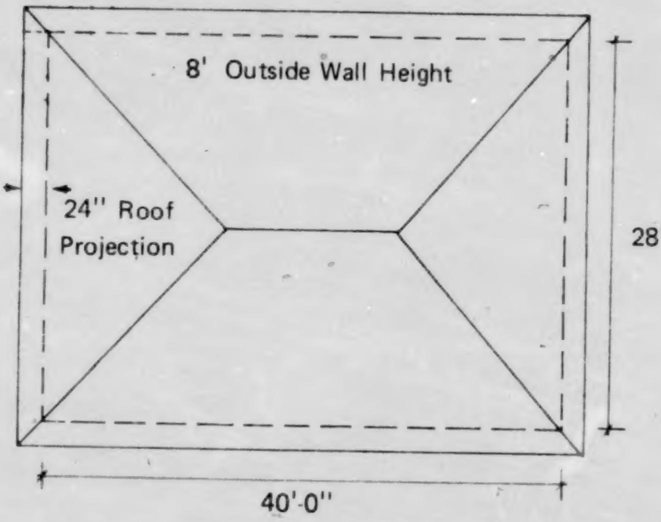

d

7. Estimate the number of square feet of eight-inch bevel siding needed for the building pictured below.

_______________________________ sq. ft.


8' Outside Wall Height
24" Roof Projection
28'-0"
40'-0"

8. Demonstrate the ability to:

   a. Build a horizontal box cornice.

   b. Apply wood siding.

   c. Apply plywood siding.

(NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

EXTERIOR PLYWOOD SIDING AND TRIM
UNIT I

ANSWERS TO TEST

1. a. 6
   b. 3
   c. 7
   d. 1
   e. 8
   f. 2
   g. 9
   h. 4
   i. 10
   j. 5
   k. 11
2. a. Horizontal box cornice
   b. Sloping box cornice
   c. Open cornice
3. a. Fascia
   b. Plancier or soffit
   c. Soffit mold or frieze
   d. Lookout
   e. Lookout ledger
   f. Blocking
   g. Rafter
4. a. 3
   b. 1
   c. 2

5. a. Horizontal siding
    1) Wood
    2) Composition board
    3) Aluminum
  b. Shingles
    1) Asbestos
    2) Wood
    3) Insulated
  c. Verticle grooved panels
    1) Plywood
    2) Composition board
  d. Boards and battens
  e. Masonry
    1) Brick veneer
    2) Rock veneer
    3) Stucco
6. a. Plywood siding
  b. Bevel siding (lap siding)
  c. Drop siding (shiplapped)
  d. Drop siding (tongue-and-grooved)
7. 1,360 sq. ft.
8. Performance skills evaluated to the satisfaction of the instructor

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COMMERCIAL CARPENTRY

PROGRESS CHART

Section I
Exterior Finish

Student's Name	UNIT I EXTERIOR PLYWOOD SIDING AND TRIM																			
	1	2	3	4	5															
Job	UNIT TEST	Material Estimating	Build Horizontal Box Cornice	Apply Wood Siding	Apply Plywood Siding															
1																				
2																				
3																				
4																				
5																				
6																				
7																				

9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
Accuracy	85% Correct	To Satisfaction of Instructor	No Exposed Joints with a Gap Greater than 1/16"	No Exposed Joints with a Gap Greater than 1/16" and ± 1/8" of Level or Plumb on 4'	± 1/8" of Plumb & Square															

[redacted]

Section J
Interior wall finish

DRY WALL
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to list the standard sizes and shapes of gypsum wallboard. The student should be able to state the advantages of using gypsum wallboard, estimate the amount of material needed, install gypsum wallboard, and apply laminated gypsum wallboard. This knowledge will be evidenced by completing the assignment sheet, job sheets, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with dry wall application to the correct definitions.
2. List the standard sizes of gypsum wallboard.
3. List the standard shapes of gypsum wallboard.
4. State advantages of using gypsum wallboard.
5. Estimate the amount of material needed to finish the interior walls and ceilings of a room with gypsum wallboard.
6. Demonstrate the ability to:
    a. Install gypsum wallboard.
    b. Apply laminated gypsum wallboard.

DRY WALL
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide student with objective sheet.

   B. Provide student with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information and assignment sheets.

   F. Demonstrate and discuss procedures outlined in job sheets.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Shapes of Gypsum Wallboard

      2. TM 2--Patterns for Hanging Wallboard

      3. TM 3--Fastening and Finishing Materials

   D. Assignment Sheet #1--Material Estimating

   E. Answers to assignment sheet

   F. Job sheets

      1. Job Sheet #1--Install Gypsum Wallboard

      2. Job Sheet #2--Apply Laminated Gypsum Wallboard

   G. Test

   H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

B. Cooper, George H., and Badzinski, Stanley Jr. *Building and Construction Estimating*. New York: McGraw-Hill, 1971.

C. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry*. 3rd ed. Chicago: American Technical Society, 1963.

D. Feirer, John L. *Woodworking for industry*. Peoria, Illinois: Charles A. Bennett Company, Inc., 1971.

E. Lair, E. A. *Carpentry for the Building Trades*. St. Louis, Missouri: McGraw-Hill Book Company, 1953.

F. Smith, Ronald C. *Principles and Practices of Light Construction*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

G. Wagner, Willis H. *Modern Carpentry*. Homewood, Illinois: Goodheart-Willcox, 1969.

DRY WALL
UNIT I

INFORMATION SHEET

I. Terms and definitions

- A. Backing--Strips of wood nailed at the inside angles of walls and partitions to provide solid corners for nailing the wallboard
- B. Dimple--Impression formed in the surface of gypsum wallboard when the nail is driven to the proper depth
- C. Dry wall--Type of construction where the interior finish material used is something other than plaster, such as gypsum wallboard
- D. Featheredge--Anything which tapers off to a thin featherlike edge
- E. Gypsum board--Modular panels from one-fourth to five-eighths inch thick, four feet wide, and six to sixteen feet in length composed of a core of gypsum sandwiched between two layers of paper
- F. Joint--Place where two pieces of wallboard meet
- G. Joint cement--Specially prepared cement used to bond the perfatape to the gypsum wallboard at the joints
- H. Perfatape--Perforated paper joint tape approximately two inches wide and in 60-, 250-, and 500-foot rolls
- I. Topping--Specially prepared substance in heavy paste form used to cover the perfatape and fill in the joint

II. Standard sizes of gypsum wallboard

- A. Thickness
  1. 1/4 inch
  2. 3/8 inch
  3. 1/2 inch
  4. 5/8 inch
- B. Width--4 feet
- C. Length
  1. 6 feet
  2. 8 feet

INFORMATION SHEET

3. 10 feet

4. 12 feet

5. 14 feet

6. 16 feet

(NOTE: 1/2" x 4' x 8' is the most common size of gypsum wallboard.)

III. Standard edge shapes of gypsum wallboard (Transparency 1)

A. Tapered edge

B. Square edge

IV. Advantages of using gypsum wallboard

A. Easy to apply

B. Low cost

C. Easy to maintain

D. Saves time

E. Noncombustible

F. Provides a good base for applying other finish materials, such as paneling, ceramic tile, accoustical tile, or wallpaper

V. Estimating the amount of material needed to finish the interior walls and ceiling of a room with gypsum wallboard

(NOTE: The unit of measurement for gypsum wallboard is square foot.)

A. Determine the total ceiling and wall area to be covered

(NOTE: No allowance is made for window and door openings unless the opening is exceptionally large.)

1. Compute the area for each room separately

(NOTE: This is done to cut down on the number of joints by ordering wallboard of a size or combination of sizes to more nearly fit the room.)

INFORMATION SHEET

2. Combine the various sizes of wallboard into groups to facilitate ordering (Transparency 2)

   Examples: 50 pieces 1/2" x 4' x 12' tapered

   120 pieces 1/2" x 4' x 8' tapered

   20 pieces 1/2" x 4' x 10' tapered

   (NOTE: Ceiling wallboard should run at right angles to the joist and horizontally on the walls whenever possible.)

B. Determine the fastening and finishing materials required using the table below (Transparency 3)

Fastening and Finishing Materials Required for 1,000 Square Feet Gypsum Drywall

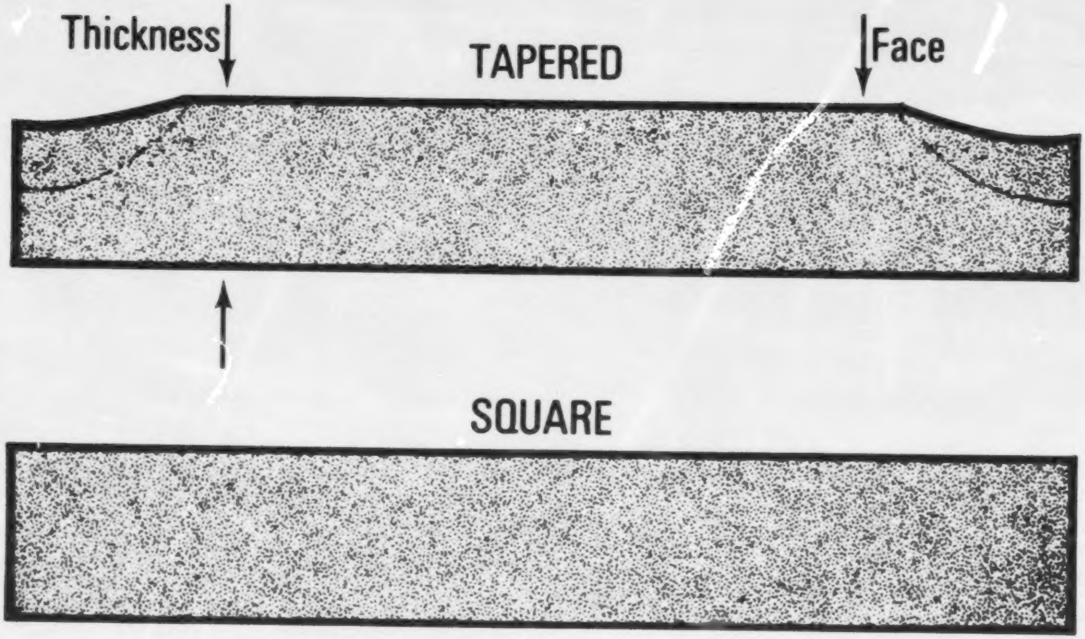
Material	Amount
1 1/4" annular ring nail	6 1/4 lb
1 3/8" annular ring nail	6 3/4 lb
1" drywall screw	3 lb
1 1/4" drywall screw	4 1/4 lb
1 5/8" drywall screw	5 1/2 lb
Joint compound	50 lb (25-lb bags)
Perforated tape	360 to 400 ft (50-foot rolls)
Texture paint	10 to 50 lb (25-lb bags)

(NOTE: Different drywall adhesives have different coverage capabilities. It is, therefore, recommended that the estimator check the coverage for the type of material to be used.)

C. Determine the number of outside metal corners needed

(NOTE: Any outside corner that will not receive casing or any other treatment should be protected with a metal corner.)

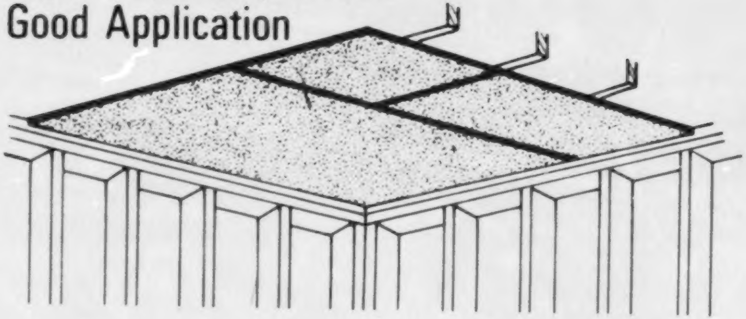
Shapes of Gypsum Wallboard


Thickness
TAPERED
Face
SQUARE

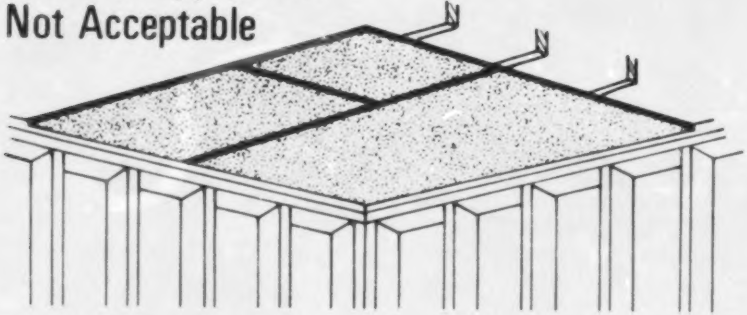
Patterns for Hanging Wallboard

CEILINGS

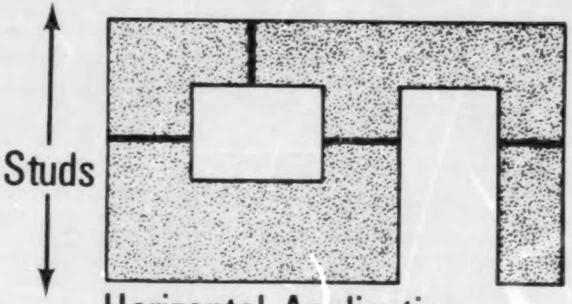
Right Angle Application
Good Application



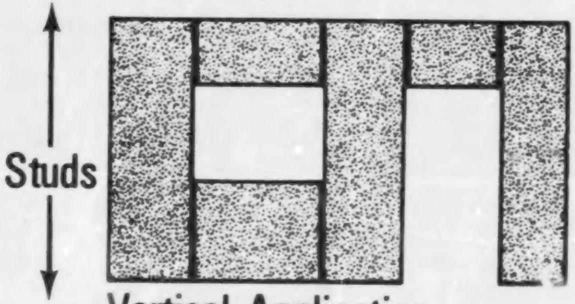
Parallel Application
Not Acceptable



WALLS



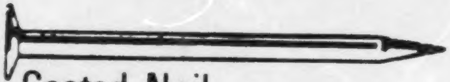
Horizontal Application
Good Application

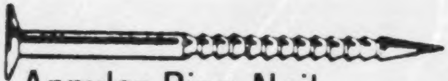


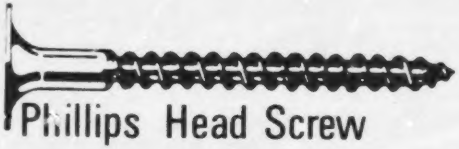
Vertical Application
Not Acceptable

Fastening and Finishing Materials

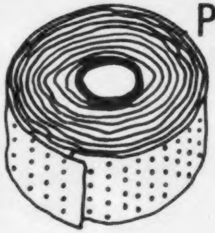
FASTENERS


Coated Nail
(Galvanized or Emulsion)

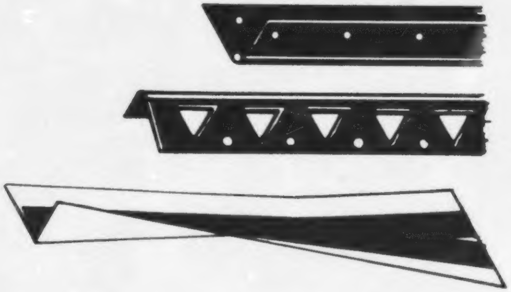

Annular Ring Nail


Phillips Head Screw

FINISHING MATERIALS


Perforated
Tape

Metal Corners



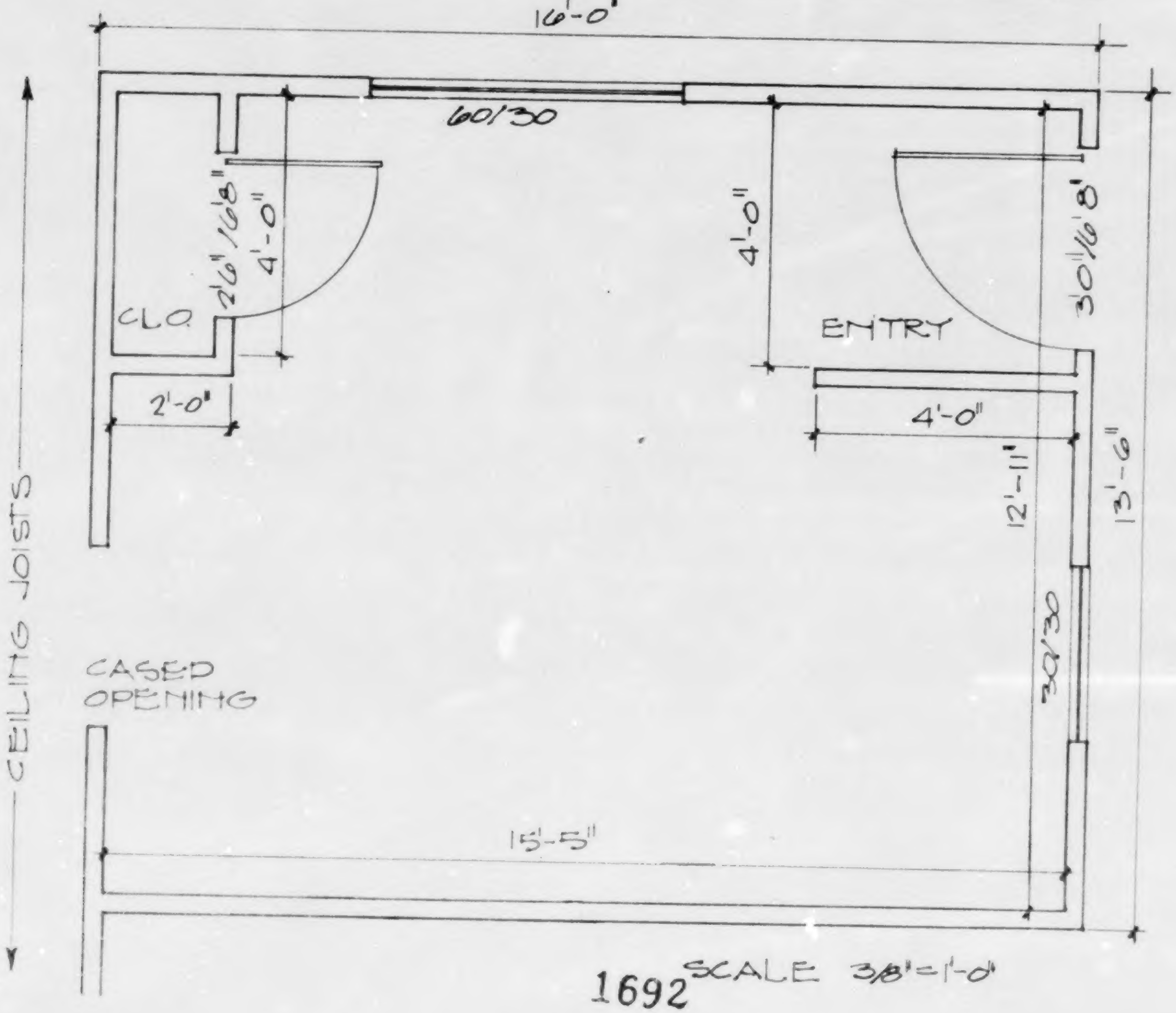
1690

DRY WALL
UNIT I

ASSIGNMENT SHEET #1--MATERIAL ESTIMATING

Using the information sheet, calculate the amount of the following materials needed to apply and finish gypsum wallboard to the ceiling and walls of the room pictured below.

1. Sq. ft. of 1/2" gypsum wallboard--____________________
2. Pounds of 1 1/4" annular ring nails--____________________
3. Feet of perforated tape (50-foot rolls)--____________________
4. Joint compound (25-pound bags)--____________________
5. Metal outside corners (8-foot lengths)--____________________


16'-0"
60/30
2'6"/6'8"
4'-0"
CLO
2'-0"
4'-0"
ENTRY
4'-0"
3'0"/6'8"
12'-11"
13'-6"
30/30
CASED OPENING
CEILING JOISTS
15'-5"
SCALE 3/8"=1'-0"

DRY WALL
UNIT I

ANSWERS TO ASSIGNMENT SHEET #1

1. 832
2. 5 1/2
3. 350
4. 50
5. 3

DRY WALL
UNIT I

JOB SHEET #1--INSTALL GYPSUM WALLBOARD

(NOTE: Metal stud installation is very similar to wood stud installation.)

I. Tools and materials

  A. Tools

    1. Drywaller's hatchet or claw hammer
    2. Steel tape measure, 12 or 16 foot
    3. Nail pouch
    4. Utility knife
    5. Straightedge, 4' or longer
    6. Compass saw
    7. Wallboard jacks
    8. Ceiling T's

  B. Materials

    1. Gypsum wallboard
    2. Nails
    3. Metal corners

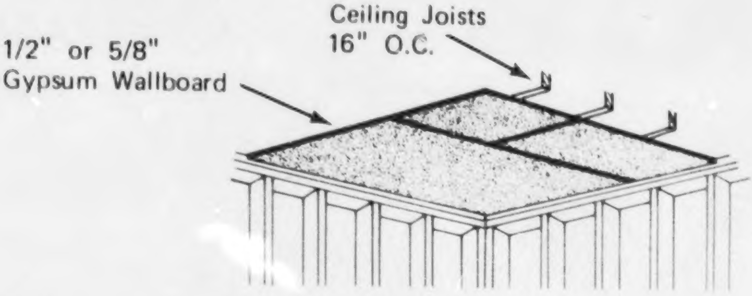
II. Procedure

(NOTE: Before any gypsum wallboard is applied, be sure that all electrical, water, gas, heating, and air conditioning rough-in work is completed and the exterior wall insulation is installed.)

  A. Ceiling

(NOTE: Ceiling wallboard should always be applied first. The length of the sheet should run at right angles to the ceiling joist. See Figure 1.)

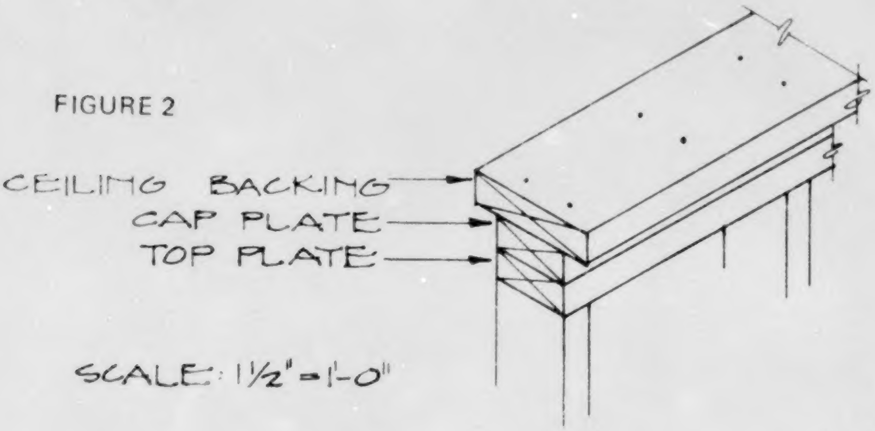
FIGURE 1



JOB SHEET #1

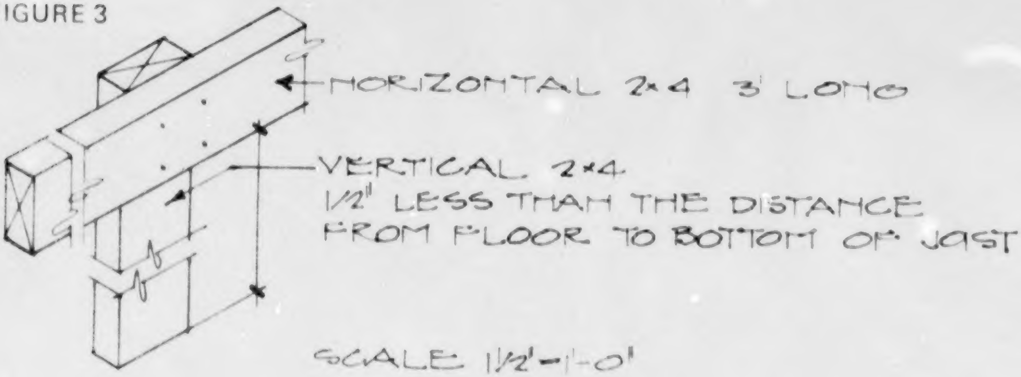
1. Install backing at ceiling and corners if it has not already been done (Figure 2)

FIGURE 2


CEILING BACKING
CAP PLATE
TOP PLATE
SCALE: 1½" = 1'-0"

2. Construct two or more T's to help support the ceiling wallboard while nailing (Figure 3)

FIGURE 3


HORIZONTAL 2×4 3' LONG
VERTICAL 2×4
1/2" LESS THAN THE DISTANCE
FROM FLOOR TO BOTTOM OF JOIST
SCALE 1½' - 1'-0'

3. Make all measurements for cutting to length and width accurately

   (NOTE: Gypsum wallboard will not compress if cut too long; therefore, these cuts should be made approximately one-eighth inch less than the exact measurement.)

4. Make cutouts for electrical boxes not more than one-eighth inch greater than the outside dimensions of the box

   (NOTE: All measurements should be from the top and side. Cut to length by using a sharp knife to cut along the straightedge through the outer paper, break the wallboard at the cut, and finish cutting the bottom paper with the knife. Cut out holes for electrical boxes with a compass saw.)

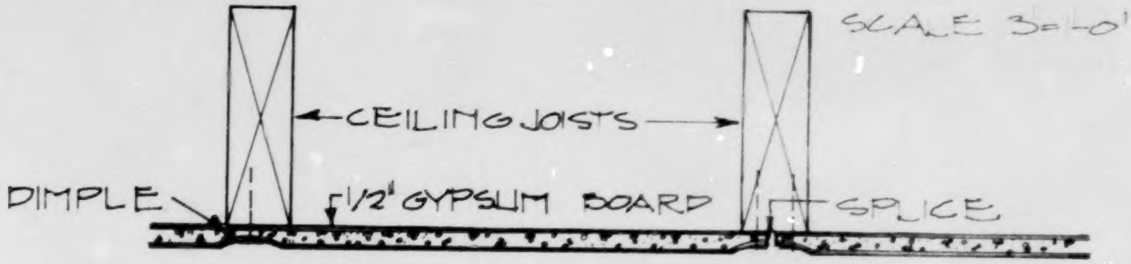
JOB SHEET #1

5. Nail ceiling wallboard approximately every seven inches on the joists

   (NOTE: Start at the center of the sheet and work out using the T's to support and hold the wallboard firmly against the joists.)

   (CAUTION: The nails must be driven deep enough to form a slight dimple or depression in the face of the wallboard but not deep enough to break the surface paper. See Figure 4.)

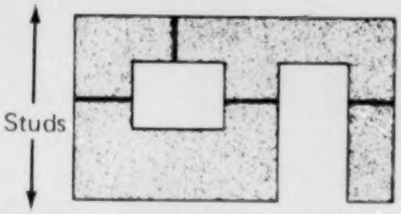
FIGURE 4



B. Walls (Figure 5)

(NOTE: Run sheets horizontally whenever possible.)

FIGURE 5



(NOTE: The sketch above shows proper cutting and fitting of the face layer, where doors and windows are in wall. Wherever practical, vertical end joints on side walls should be placed above door and window openings to reduce joint treatment to a minimum.)

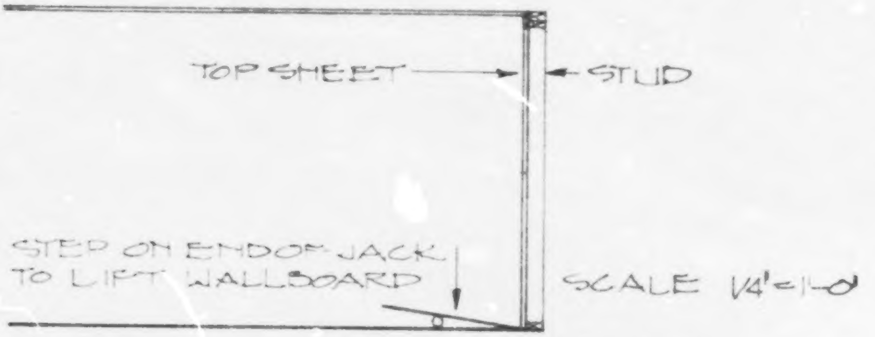
1. Hang the first sheet horizontally, being sure that the top edge is snug against the ceiling

   (NOTE: Nail the wallboard to the studs with a nail approximately every nine inches, following the same instructions for dimpling as on the ceiling.)

JOB SHEET #1

2. Nail the bottom sheet using the wallboard jacks to lift the wallboard and hold it in place (Figure 6)

FIGURE 6


TOP SHEET
STUD
STEP ON END OF JACK
TO LIFT WALLBOARD
SCALE 1/4"=1'-0"

3. Follow the same procedure for cutting to length and for cutting out electrical boxes as used for the ceiling

4. Allow material to cover door and window openings and cut out later

DRY WALL
UNIT I

JOB SHEET #2--APPLY LAMINATED GYPSUM WALLBOARD

I. Tools and materials

  A. Tools

    1. Drywall hammer
    2. Utility knife
    3. Carrier lifter
    4. Foot lifter
    5. Utility saw
    6. Drywall T square
    7. Drywall screwdriver
    8. Rubber mallet

  B. Materials

    1. Gypsum wallboard (backer board)
    2. Gypsum wallboard (recessed edge)
    3. Screws
    4. Adhesive

III. Procedure

  A. Install base layer (backer board)

    1. Stand panel with long length vertical

       (NOTE: When using vinyl panels for face layer, install base layer horizontally.)

    2. Center edge of panel on stud
    3. Screw panel to stud

       (NOTE: Stagger panels on opposite side of wall so they occur on different studs.)

JOB SHEET #2

4. Continue installation repeating steps A 1 through A 3

   (NOTE: Screw spacing for adhesive laminated face should be 8" o.c. at joints and 12" o.c. in the field.)

B. Install face panel

   1. Cut panel for length

      (NOTE: Face panel will be horizontal.)

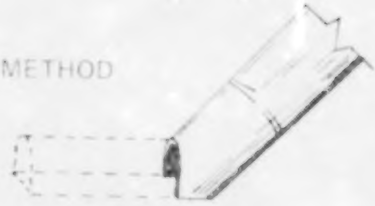
   2. Lay panel on horses back side up

   3. Spread adhesive on panel (Figure 1)

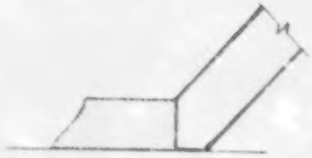
      (NOTE: Adhesive beads should be 3/8" wide by 1/2" high and maximum of 2" o.c.)

FIGURE 1

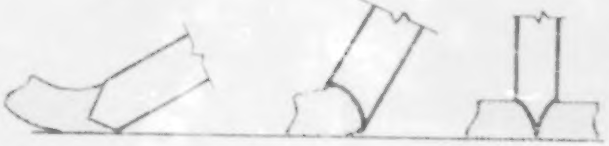
TUBE GUN METHOD



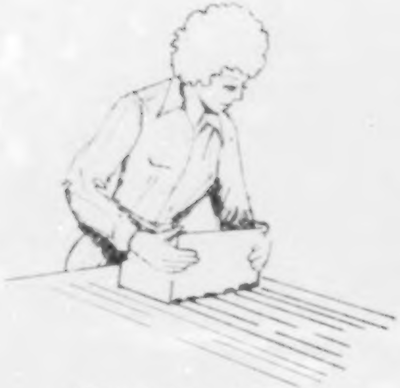
Size Opening and Bead of Adhesive



Correct Position



Incorrect Positions



Spreader Used to Apply Adhesive to Back of Panel

   4. Position panel on base panel

      (NOTE: Install top panel first on 8' 2" ceiling.)

JOB SHEET #2

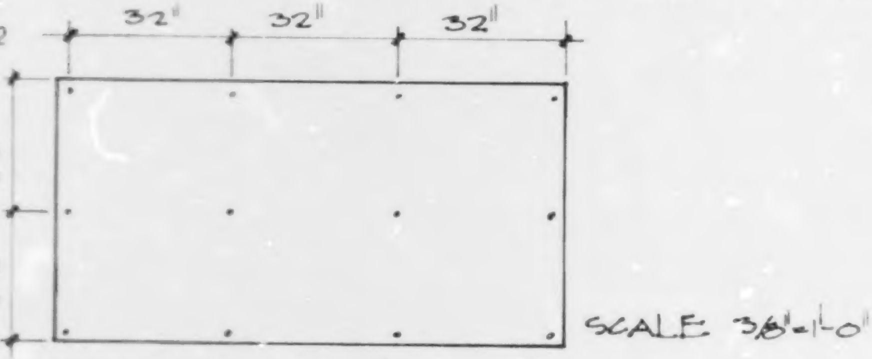
5. Secure panel by temporary nailing

   (NOTE: Impact entire area with a rubber mallet to assure a good bond.)

6. Screw panel to studs (Figure 2)

   (NOTE: Impact entire area with a rubber mallet to assure bond.)

FIGURE 2



7. Nail panel to studs (wood studs)

   a. Nail panels on edge where tape will cover

   b. Drive temporary nails in field of panel

      (NOTE: Duplex nails or scraps of sheetrock and any smooth nail long enough may be used to penetrate the stud.)

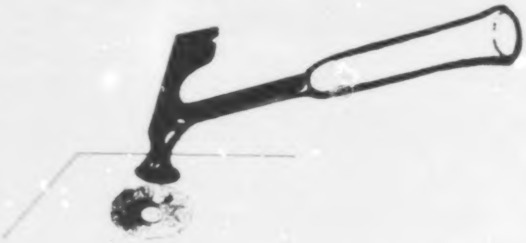
   c. Leave temporary nailing for twenty-four hours

   d. Remove temporary nailing

      (NOTE: Place block of wood under hammer while removing nails. Do not break face paper.)

   e. Dimple nail hole with drywall hammer (Figure 3)

FIGURE 3



DRY WALL
UNIT I

TEST

NAME ______________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

    _____a. Type of construction where the interior finish material used is something other than plaster, such as gypsum wallboard

    _____b. Place where two pieces of wallboard meet

    _____c. Impression formed in the surface of gypsum wallboard when the nail is driven to the proper depth

    _____d. Specially prepared substance in heavy paste form used to cover the perfatape and fill in the joint

    _____e. Anything which tapers off to a thin feather-like edge

    _____f. Specially prepared cement used to bond the perfatape to the gypsum wallboard at the joints

    _____g. Strips of wood nailed at the inside angles of walls and partitions to provide solid corners for nailing the wallboard

    _____h. Modular panels from one-fourth to five-eighths inch thick, four feet wide, and six to sixteen feet in length composed of a core of gypsum sandwiched between two layers of paper

    _____i. Perforated paper joint tape approximately two inches wide and in 60-, 250-, and 500-foot rolls

    1. Backing
    2. Dimple
    3. Dry wall
    4. Featheredge
    5. Gypsum board
    6. Joint
    7. Joint cement
    8. Perfatape
    9. Topping

2. List the standard sizes of gypsum wallboard.

    a. Thickness

        1) ______________________________

        2) ______________________________

3) ______________________

4) ______________________

b. Width-- ______________________

c. Length

1) ______________________

2) ______________________

3) ______________________

4) ______________________

5) ______________________

6) ______________________

3. List the standard shapes of gypsum wallboard.

a. ____

b. ____

4. State four advantages of using gypsum wallboard.

a. ____

b. ____

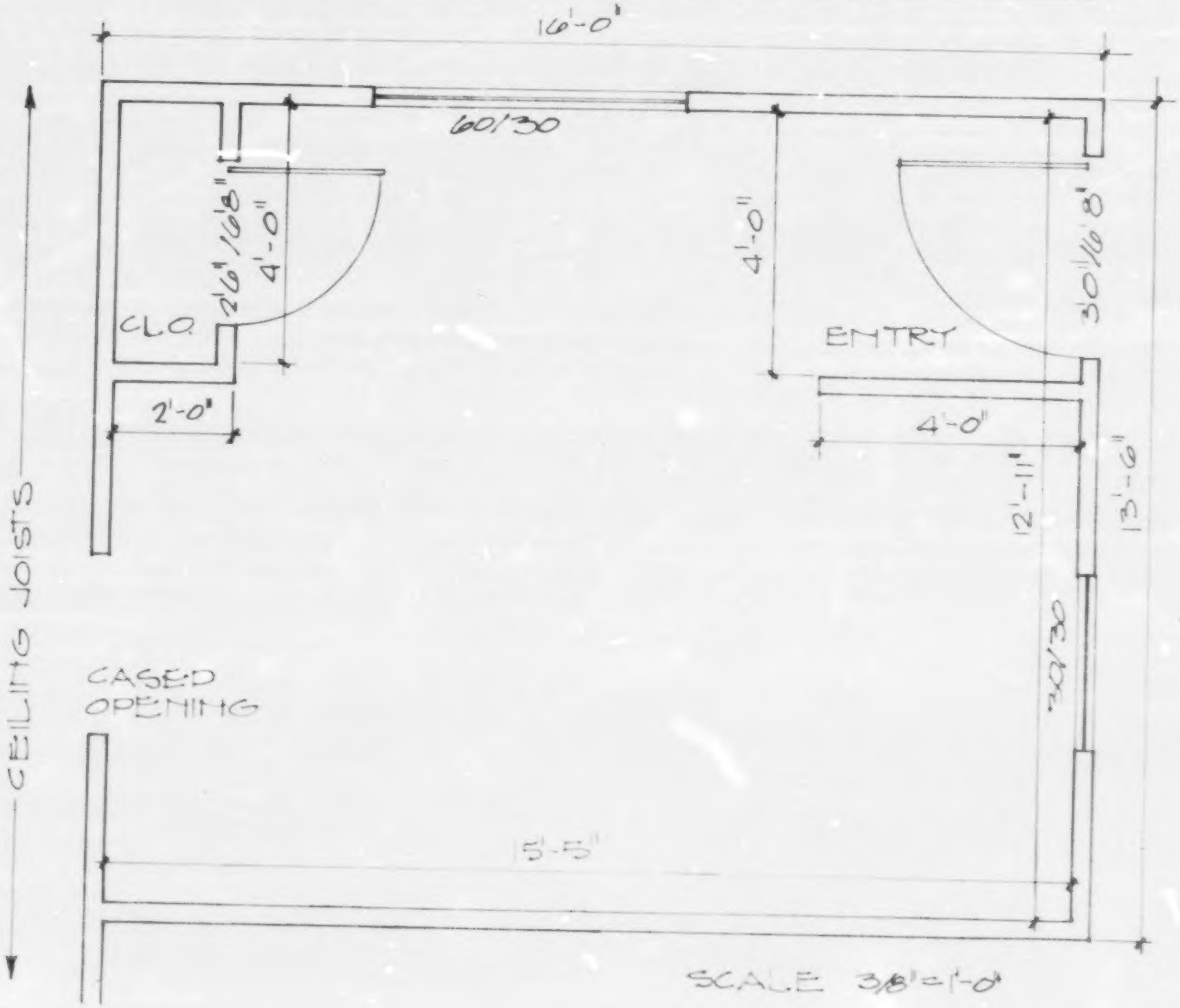
c. ____

d. ____

5. Estimate the amount of one-half inch gypsum wallboard needed for the walls and ceiling of the room illustrated below.

   a. Walls--____________________________________

   b. Ceiling--____________________________________


16'-0"
60/30
2'6"/6'8"
4'-0"
4'-0"
30"/6'8"
CLO
ENTRY
2'-0"
4'-0"
12'-11"
13'-6"
CEILING JOISTS
CASED OPENING
30/30
15'-5"
SCALE 3/8"=1'-0"

6. Demonstrate the ability to:

   a. Install gypsum wallboard.

   b. Apply laminated gypsum wallboard.

(NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

DRY WALL
UNIT I

ANSWERS TO TEST

1. a. 3
   b. 6
   c. 2
   d. 9
   e. 4
   f. 7
   g. 1
   h. 5
   i. 8
2. a. Thickness
      1) 1/4"
      2) 3/8"
      3) 1/2"
      4) 5/8"
   b. Width--4 feet
   c. Length
      1) 6'
      2) 8'
      3) 10'
      4) 12'
      5) 14'
      6) 16'
3. a. Tapered edge
   b. Square edge

4. Any four of the following:
    a. Easy to apply
    b. Low cost
    c. Easy to maintain
    d. Saves time
    e. Noncombustible
    f. Provides a good base for applying other finish materials, such as paneling, ceramic tile, accoustical tile, or wallpaper
5. a. 624 sq. ft.
    b. 208 sq. ft.
6. Performance skills evaluated to the satisfaction of the instructor

1404-A

section K
Interior trim

STAIR CONSTRUCTION
UNIT I

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the parts of a staircase, state the rule of thumb for unit rise and unit run, calculate the number of risers and treads, and list the items to consider in building a staircase. The student should also be able to lay out, cut, and assemble a housed stair. This knowledge will be evidenced by completion of the assignment sheet, job sheet, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with stair construction to the correct definitions.
2. Identify the parts of a staircase.
3. Identify the basic types of stairs.
4. Identify the ways stairs are fitted into the building.
5. State the rule of thumb for unit rise and unit run.
6. Calculate the number of risers and treads for a stair of given dimensions.
7. List factors that must be considered in building a staircase.
8. Estimate the materials for a housed stair.
9. Identify methods of securing stringers.
10. Demonstrate the ability to lay out, cut, and assemble a housed stair.

STAIR CONSTRUCTION
UNIT I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information, assignment, and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives and information and assignment sheets.

   E. Provide students with framing square and gauges for use on assignment sheet.

   F. Demonstrate and discuss procedures outlined in job sheet.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Parts of a Staircase

      2. TM 2--Types of Stairs

      3. TM 3--Ways Stairs Are Fitted into Buildings

      4. TM 4--Rise and Run of Stairs

      5. TM 5--Unit Rise and Unit Run

      6. TM 6--Methods of Securing Stringers

   D. Assignment Sheet #1--Material Estimating

   E. Answers to assignment sheet

   F. Job Sheet #1--Lay Out, Cut, and Assemble a Housed Stair

   G. Test

   H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago, Illinois: American Technical Society, 1955.

B. Cooper, George H., and Badzinski, Stanley Jr. *Building and Construction Estimating*. New York: McGraw-Hill, 1971.

C. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry*. 3rd ed. Chicago, Illinois: American Technical Society, 1963.

D. Lair, E. A. *Carpentry for the Building Trades*. St. Louis, Missouri: McGraw-Hill, 1953.

E. Smith, Ronald C. *Principles and Practices of Light Construction*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

F. Wagner, Willis H. *Modern Carpentry*. Homewood, Illinois: Goodheart-Willcox, 1969.

G. Ramsey, Charles G., and Sleeper, Harold R. *Architectural Graphic Standards*. 4th ed. New York: John Wiley and Sons, Inc., 1951.

STAIR CONSTRUCTION
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Baluster--Upright support of the handrail for a stair

B. Head room--Clear space between the tread of a stair and the ceiling above

C. Handrail--Rail on a stair used for support; sometimes called a *baluster rail*

D. Housed stair--Staircase in which the stringers are housed between two walls

E. Landing--Platform introduced at some point to change the direction of the stairway or to break the run

F. Line of flight--Angle of ascent of a stair

G. Newel post--Upper or lower post which supports the handrail of a stair

H. Nosing--Rounded edge of a stair tread that projects over the riser

I. Open stair--Stair which has both sides open to a room or hall

J. Rise--Distance between two landings

K. Riser--Vertical distance under the edge of a stair tread which may be open or closed

L. Run--Horizontal distance from a point at the head of a stair to the outside end of the last riser

M. Semihoused stair--Staircase which has one side open to a room or hall

N. Staircase--Complete flight of steps leading from one floor or story to another above

O. Stairwell--Compartment extending vertically through a building in which stairs are placed

P. Stringer--Inclined supports of a flight of stairs

Q. Tread--That portion of a step on which the foot is placed when mounting the stairs

INFORMATION SHEET

II. Parts of a staircase (Transparency 1)

- A. Headroom
- B. Landing
- C. Rise
- D. Run
- E. Tread
- F. Riser
- G. Stringer
- H. Unit rise
- I. Unit run
- J. Nosing
- K. Baluster
- L. Newel post
- M. Handrail or baluster rail
- N. Stairwell
- O. Clearance
- P. Nosing piece

III. Types of stairs (Transparency 2)

(NOTE: Stairs are classified by shape and by the way they are fitted into the building.)

- A. Straight flight
- B. Straight flight with landing
- C. L-shaped
- D. Winder
- E. Circular

INFORMATION SHEET

IV. Ways stairs are fitted into a building (Transparency 3)

- A. Housed
- B. Semihoused
- C. Open

V. Rule of thumb for unit rise and unit run--Total of one riser and one tread should not be less than sixteen or more than eighteen inches (Transparency 4)

- A. Unit rise should be 7" - 8"
- B. Unit run should be 9" - 11"

(NOTE: As the rise increases, the run must decrease proportionally.)

(CAUTION: All treads and all risers for a stair must be of the same size.)

VI. Calculating the number of risers and treads for a stair (Transparencies 4 and 5)

(NOTE: A stair chart may also be used. See chart on next page.)

A. Risers

1. Determine the total rise of the stair in inches

   (NOTE: The total rise of a stair is from the finished floor of the lower level to the top of the finished floor of the upper level.)

2. Divide the total rise of the stair by seven to get the number of risers needed

   (NOTE: The number seven is the minimum height of a riser.)

3. Round back to the nearest whole number

4. Divide by number of risers to get unit rise

Example: In Transparency 5 the total rise for the stair is 7'-10 1/4" or 94 1/4"; 94 1/4" ÷ 7 = 13 7/16; 7/16 will not make a full riser so round back to 13 full risers; 94 1/4" ÷ 13 = 7.250" or 7 1/4" unit rise.

There will be 13 risers of 7 1/4" each.

INFORMATION SHEET

B. Treads

1. Determine the total run of the stair in inches

   (NOTE: The total run of the stair is the horizontal distance from a point at the head of a stair to the outside edge of the last riser.)

2. Divide the total run of the stair by nine to get the number of treads needed

   (NOTE: Nine inches is the minimum width of a tread.)

3. Round back to the nearest whole number

4. Divide by number of treads to get unit run

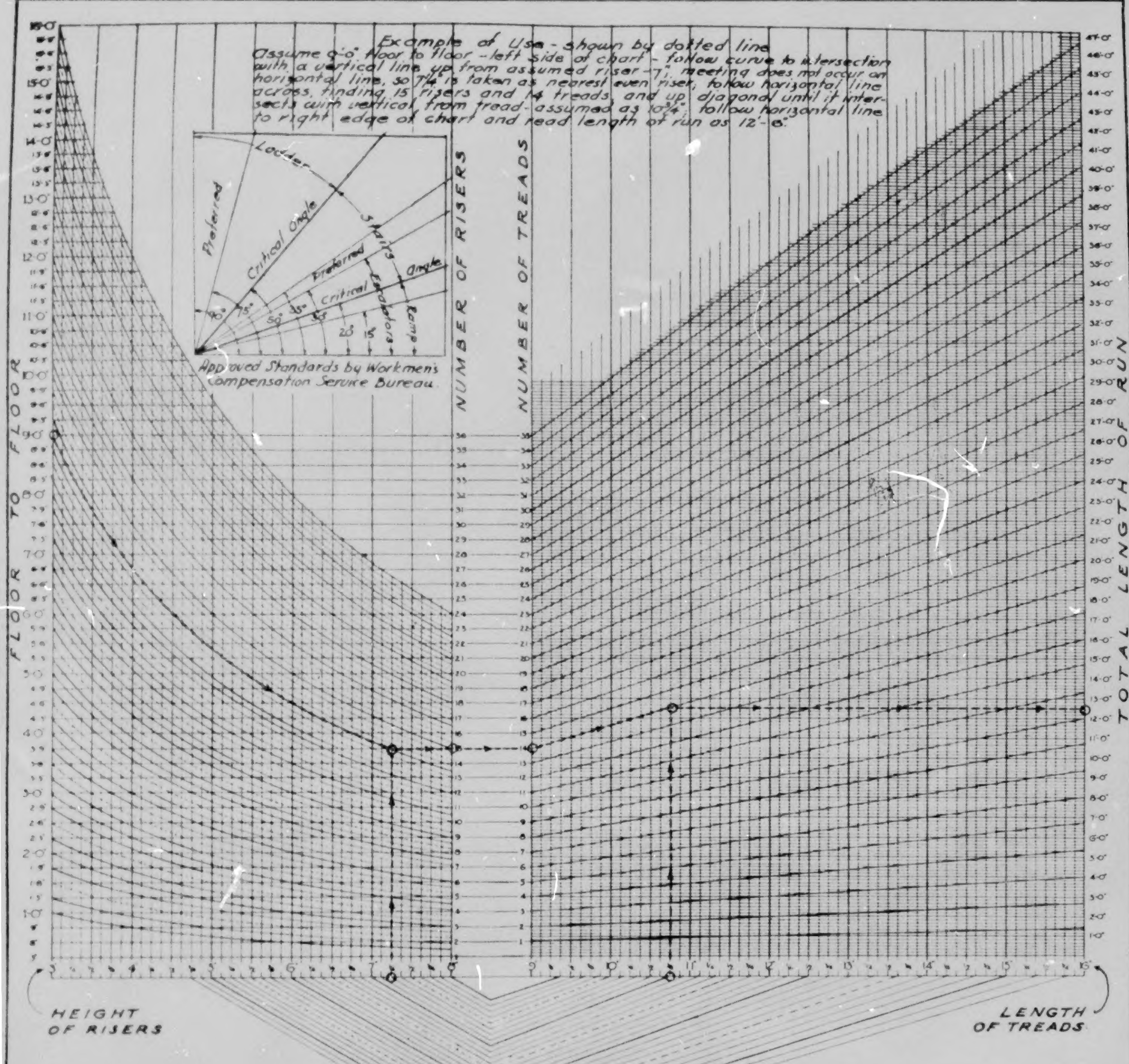
   Example: In Transparency 5 the total run for the stair is 9'-0" or 108";
   108 ÷ 9 = 12 full treads, 108" ÷ 12 = 9" unit run.

   There will be 12 treads of 9" each.

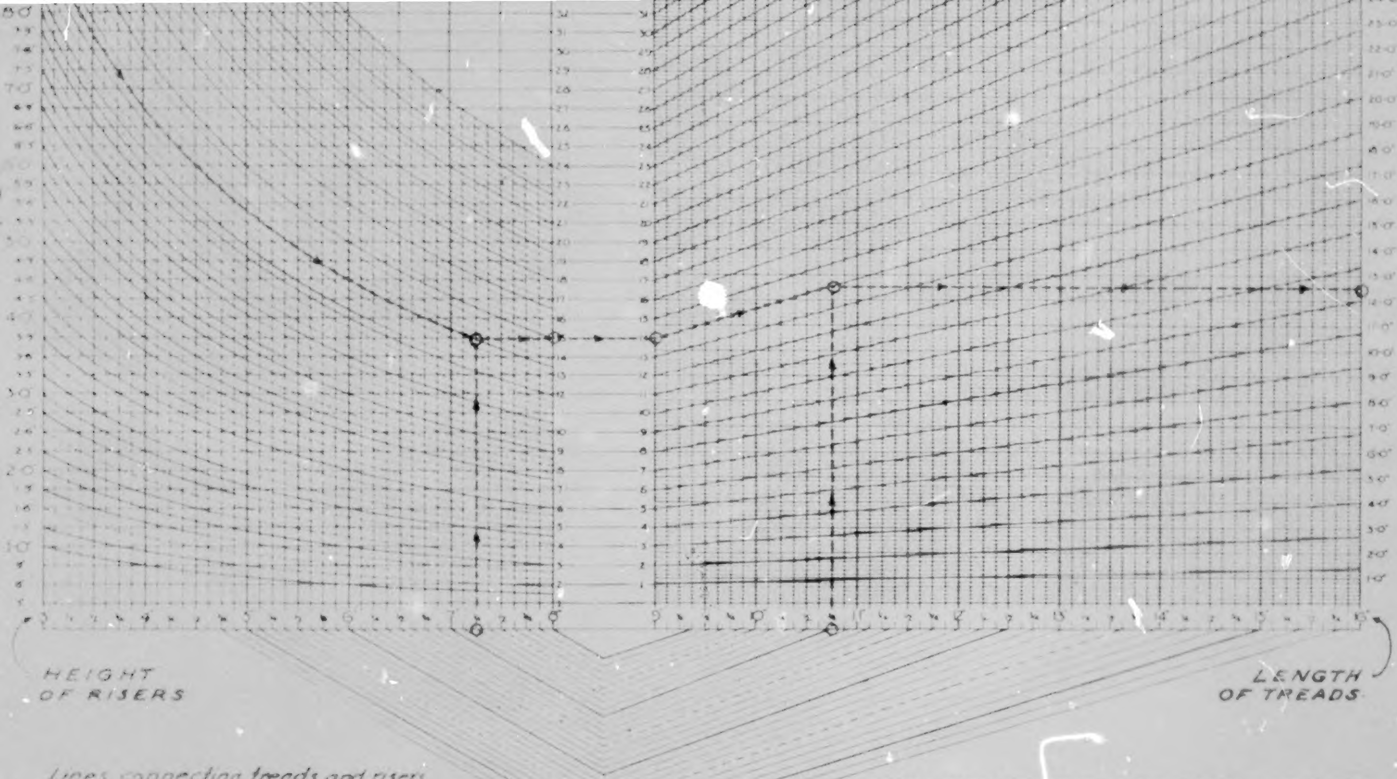
1713

INFORMATION SHEET

STAIR DATA



Example of Use - shown by dotted line
Assume 9'-0" floor to floor - left side of chart - follow curve to intersection with a vertical line up from assumed riser - 7"; meeting does not occur on horizontal line, so 7¼" is taken as nearest even riser; follow horizontal line across, finding 15 risers and 14 treads, and up diagonal until it intersects with vertical from tread - assumed as 10¾"; follow horizontal line to right edge of chart and read length of run as 12'-6".



Lines connecting treads and risers are based on product of tread & riser = 75 (above); these lines may be disregarded and any other rule substituted. They do not apply to exterior stairs.

Another rule commonly used is:— Run + Riser = 17½. Run equals tread less nosing.

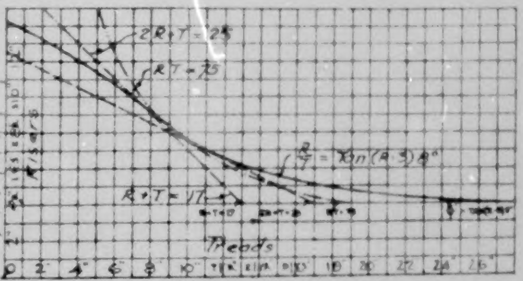
Recommendations:—

Minimum width of tread with nosing = 11", except stairs with open risers.

Maximum width of tread with nosing = 15" Maximum height of riser = 7¾", minimum = 6".

Table of stair proportions using Formula $\frac{R}{T} = \tan(R-3)8^\circ$

Riser	Tread	Riser	Tread	Riser	Tread
4"	28.3"	5¾"	14.2"	7½"	10.3"
4¼"	24.1"	6"	13.6"	7¾"	9.9"
4½"	21.2"	6¼"	12.8"	8"	9.5"
4¾"	19.1"	6½"	12.2"	8¼"	9.2"
5"	17.6"	6¾"	11.7"	8½"	8.8"
5¼"	16.2"	7"	11.2"	8¾"	8.5"
5½"	15.1"	7¼"	10.7"	9"	8.1"



STAIR PROPORTIONS USING FORMULA $\frac{R}{T} = \mathrm{TAN}(R-3)8^\circ$

Formula devised by Jamieson Parker. A.I.A.
Reprinted by permission of "Architecture"

Conceived by Frederick L. Ackerman, Architect

eprinted by permission of John Wiley and Sons, Inc. from *Architectural Graphic Standards* by Ramsey and Sleeper, copy-
ght 1951, fourth edition.

INFORMATION SHEET

VII. Factors to be considered in building a staircase

(NOTE: Refer to building code.)

A. Width

(NOTE: The minimum width is three feet and preferably four feet.)

B. Headroom

(NOTE: The minimum allowable headroom is 6'-8" for a main stair and 6'-4" for a basement or service stair.)

C. Line of flight

(NOTE: The preferred angle for a stair is from 30 to 35 degrees.)

D. Unit rise

(NOTE: The unit rise should be from seven to eight inches to be comfortable, but all risers for a stair must be of uniform height.)

E. Unit run

(NOTE: The unit run should be from nine to eleven inches to be comfortable, but all treads for a stair must be of uniform width.)

F. Baluster rail height

(NOTE: The distance from the top of the baluster rail to the top of a tread, at the middle, should be no less than thirty-two inches and no greater than thirty-six inches.)

VIII. Material estimating for a housed stair

(NOTE: See building specifications for kinds and dimensions of material.)

A. Stringers

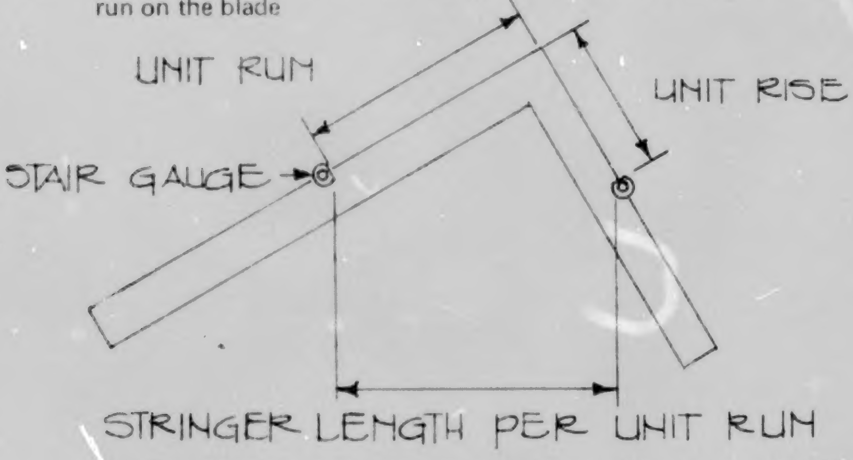
1. Determine the length needed

a. Determine the number of risers and the number of treads

b. Determine the unit rise and unit run

INFORMATION SHEET

c. Locate the unit rise on the tongue of a framing square and the unit run on the blade



(NOTE: The diagonal measurement from the unit run to the unit rise on the square illustrated above equals the stringer length per unit run.)

d. Multiply the stringer length per unit run, in inches, by the number of treads to get the length of the stringer in inches

e. Divide by twelve to get the length of the stringer in feet

f. Add two feet for waste at each end

Example: Using the stair illustrated in Transparency 5, the unit rise is 7 1/4", the unit run is 9", the number of treads is twelve, and the stringer length per unit run equals twelve inches.

12 x 2 = 144"
144 ÷ 12 = 12' + 2' = 14'

The stringer material needs to be 14' long.

2. Determine the number of stringers needed from the specifications

(NOTE: A minimum of two are needed for a stair thirty-six inches wide.)

B. Treads

1. Determine the width of a tread

(NOTE: The width of a tread is the unit run plus the amount of nosing desired.)

INFORMATION SHEET

2. Determine the thickness of a tread

   (NOTE: For a basement stair, the treads are usually made from two-inch material.)

3. Determine the length of a tread

   (NOTE: For a housed stair, the length of a tread will be the distance between the two walls that house the stair.)

4. Multiply length of a tread by the number of treads to equal the running feet of material needed

   Example: Using the stair illustrated in Transparency 5, the unit run is 9", the nosing is 1 1/4", the stairwell opening is thirty-six inches, and the number of treads are twelve. It will be necessary to use 2 x 12's for the treads.

   3' x 12 = 36' of 2 x 12's

   3 - 2 x 12 x 12' will make 12 - 3' treads

C. Risers

1. Determine the height of a riser

   (NOTE: The unit rise will be the height of the riser.)

2. Determine the thickness of the riser

   (NOTE: Risers are usually cut from one-inch material.)

3. Determine the length of the risers

   (NOTE: For a housed stair, the length of a riser will be the distance between the two walls that house the stair.)

4. Multiply length of a riser by the number of risers to equal the running feet of material needed

   Example: Using the stair illustrated in Transparency 5, the unit rise is 7 1/4", the width of the stairwell is 36", and the number of risers is 13. It will be necessary to use 1 x 8's for the risers.

   3' x 13 = 39' of 1 x 8's
   2 - 1 x 8 x 12' and 1 - 1 x 8 x 16' will make 13 - 3' risers

INFORMATION SHEET

D. Nails

1. 16d casing (for treads)

   (NOTE: It takes approximately three pounds of 16d casing nails for a basement stair.)

2. 16d box (for stringers)

   (NOTE: It takes approximately two pounds of 16d box nails for a basement stair.)

3. 8d box (for risers)

   (NOTE: It takes approximately two pounds of 8d box nails for a basement stair.)

E. Baluster rail

(NOTE: The rail should be the same length as the stringers and one for each side.)

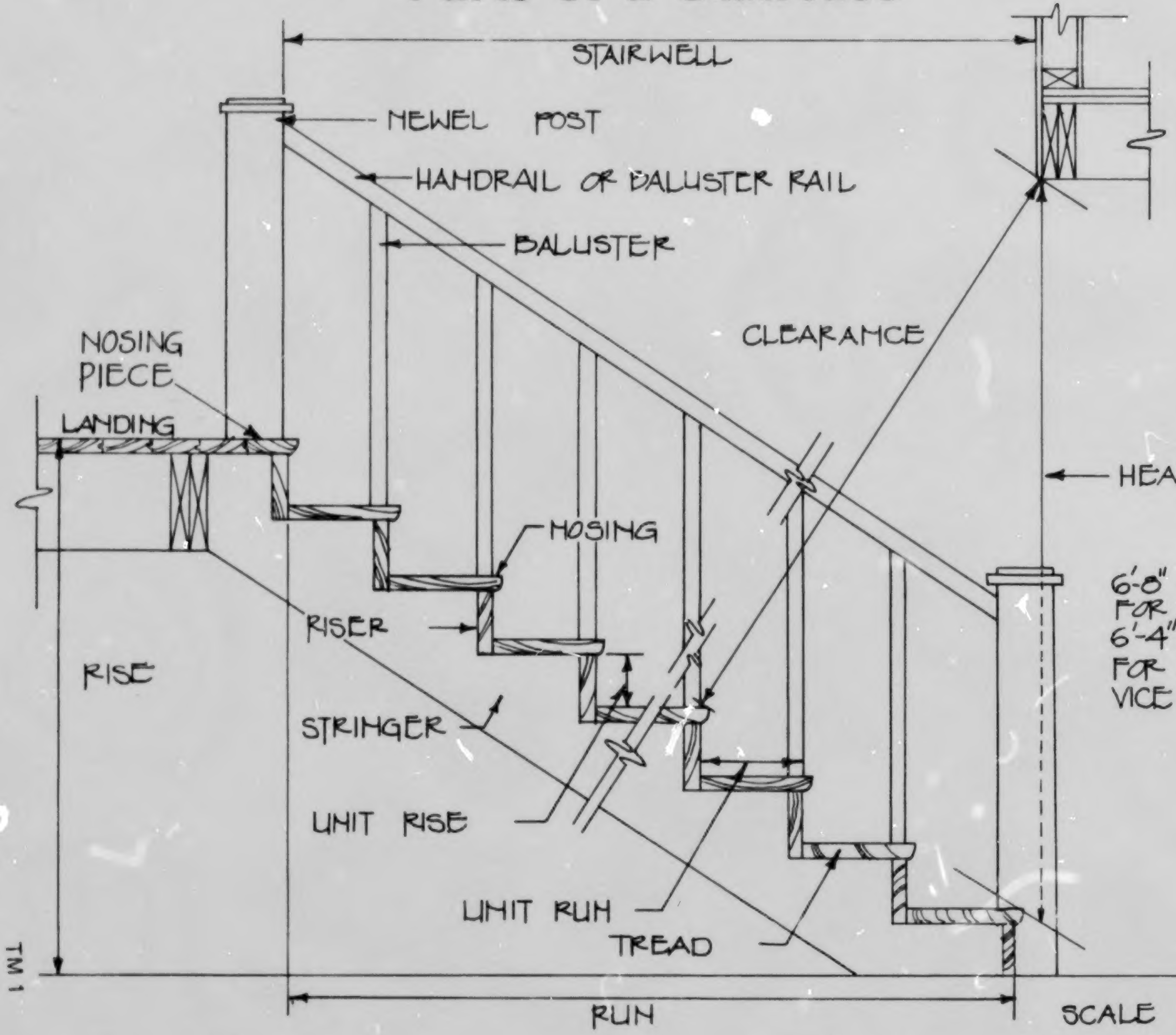
IX. Methods of securing stringers (Transparency 6)

A. Ledger strip

B. Hangers

C. Nailed from rear

Parts of a Staircase


STAIRWELL
NEWEL POST
HANDRAIL OR BALUSTER RAIL
BALUSTER
NOSING PIECE
LANDING
CLEARANCE
HEADROOM
NOSING
RISER
RISE
STRINGER
UNIT RISE
UNIT RUN
TREAD
RUN

FHA
6'-8" MINIMUM HEADROOM FOR MAIN STAIR.
6'-4" MINIMUM HEADROOM FOR BASEMENT OR SERVICE STAIR.

SCALE 3/4" = 1'-0"

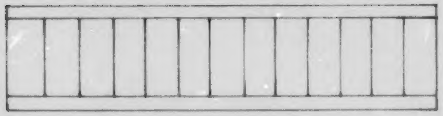
TM 1

CC-15-K

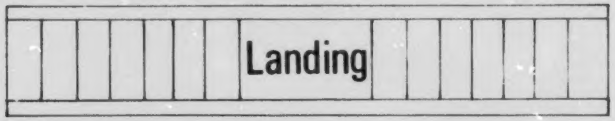
1719

172

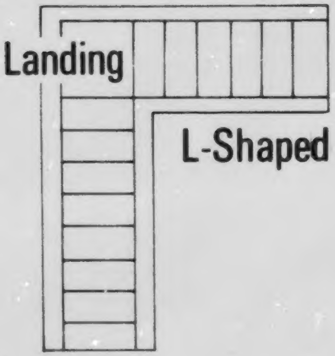
Types of Stairs



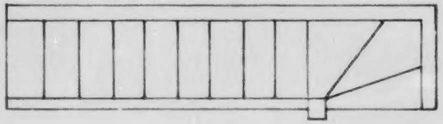
Straight flight



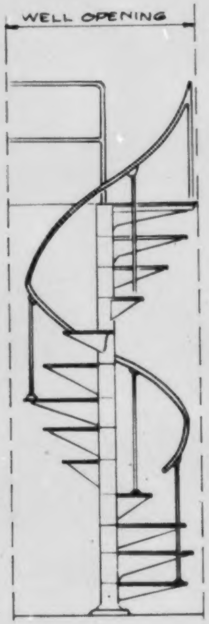
Straight flight with landing



L-Shaped

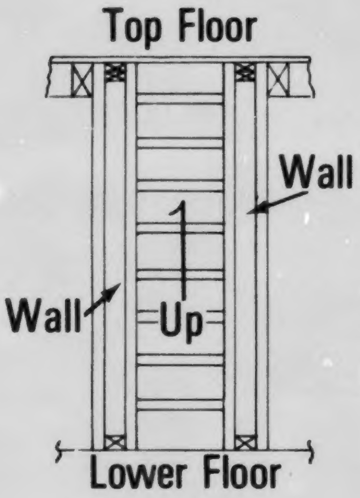


Winder

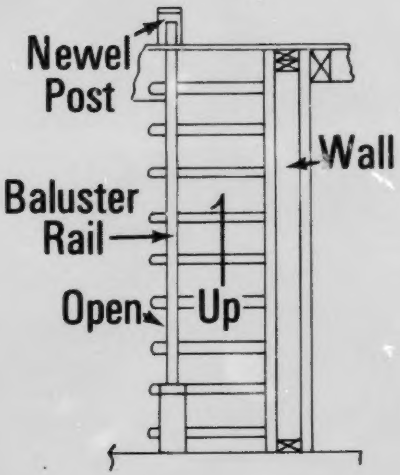

WELL OPENING

Circular

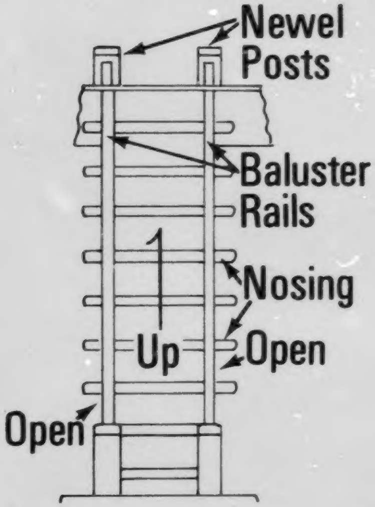
Ways Stairs Are Fitted Into Buildings


Top Floor
Wall
Wall
Up
Lower Floor

Housed Stair


Newel Post
Wall
Baluster Rail
Open
Up

Semihoused Stair


Newel Posts
Baluster Rails
Nosing
Open
Up
Open

Open Stair

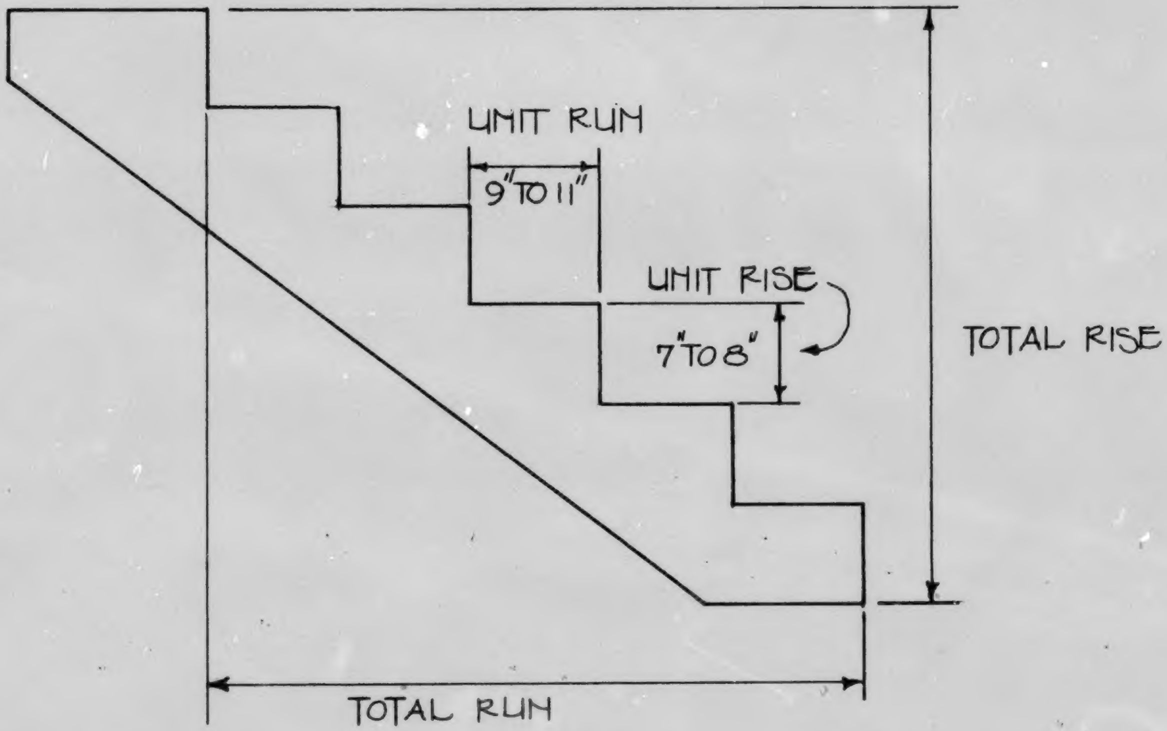
TM 3

1723

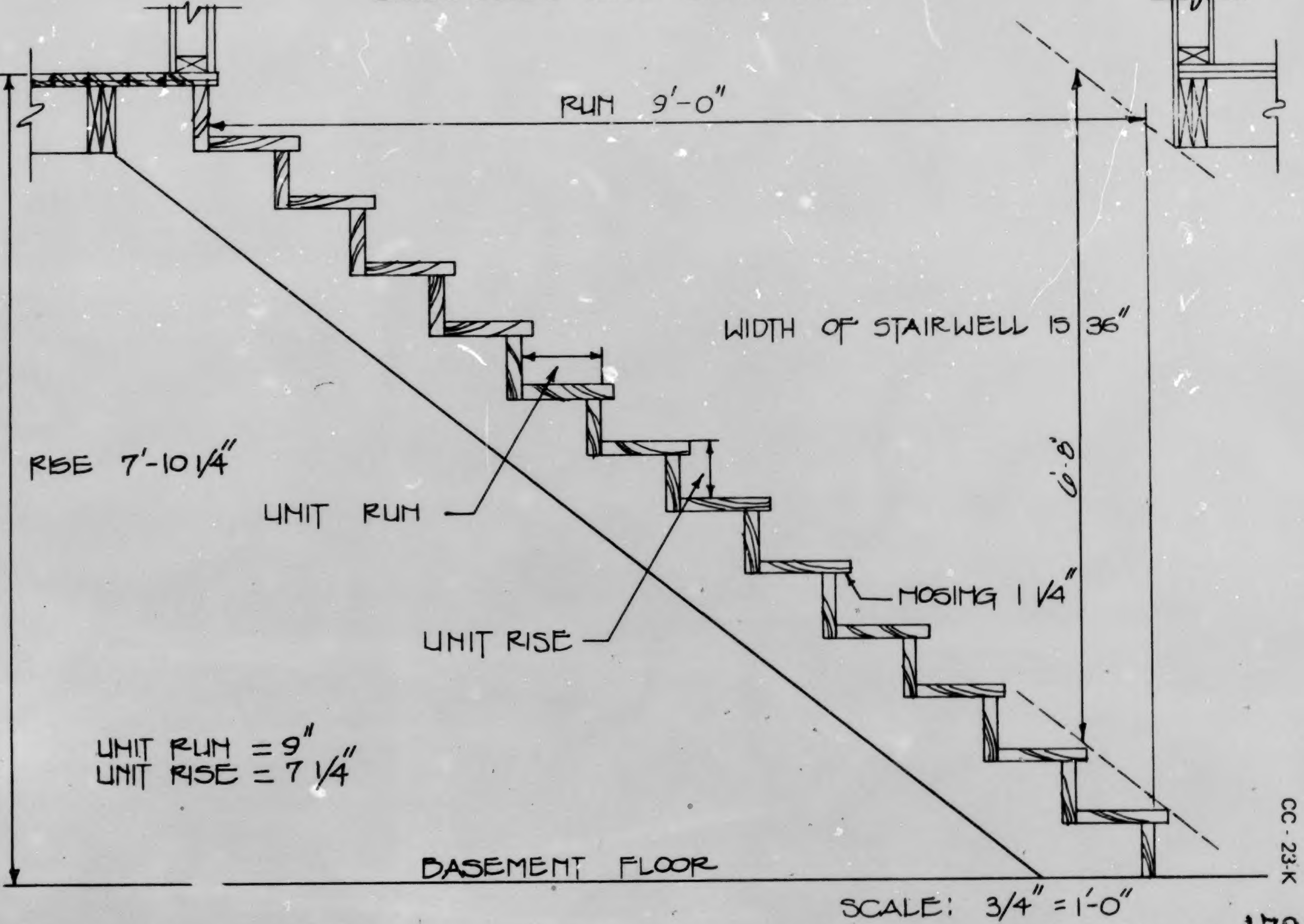
1724

CC - 19-K

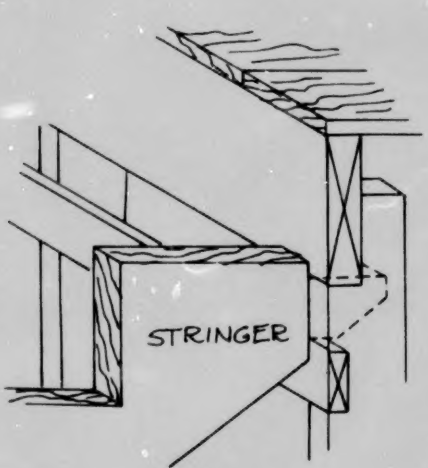
Rise and Run of Stairs


UNIT RUN
9" TO 11"
UNIT RISE
7" TO 8"
TOTAL RISE
TOTAL RUN

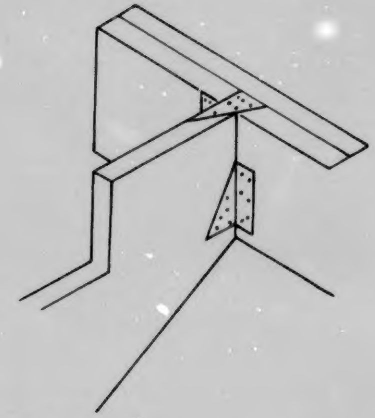
Unit Rise and Unit Run


RUN 9'-0"
WIDTH OF STAIRWELL IS 36"
RISE 7'-10 1/4"
UNIT RUN
UNIT RISE
NOSING 1 1/4"
6'-8"
UNIT RUN = 9"
UNIT RISE = 7 1/4"
BASEMENT FLOOR
SCALE: 3/4" = 1'-0"

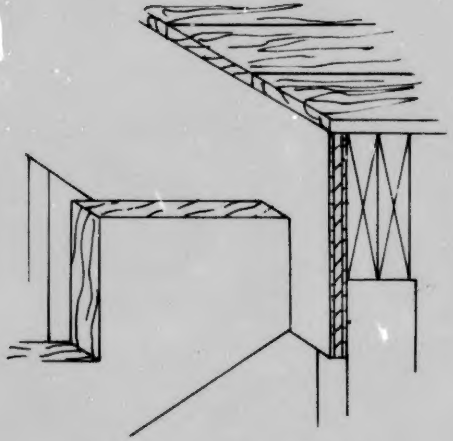
Methods of Securing Stringers



LEDGER STRIP



HANGERS



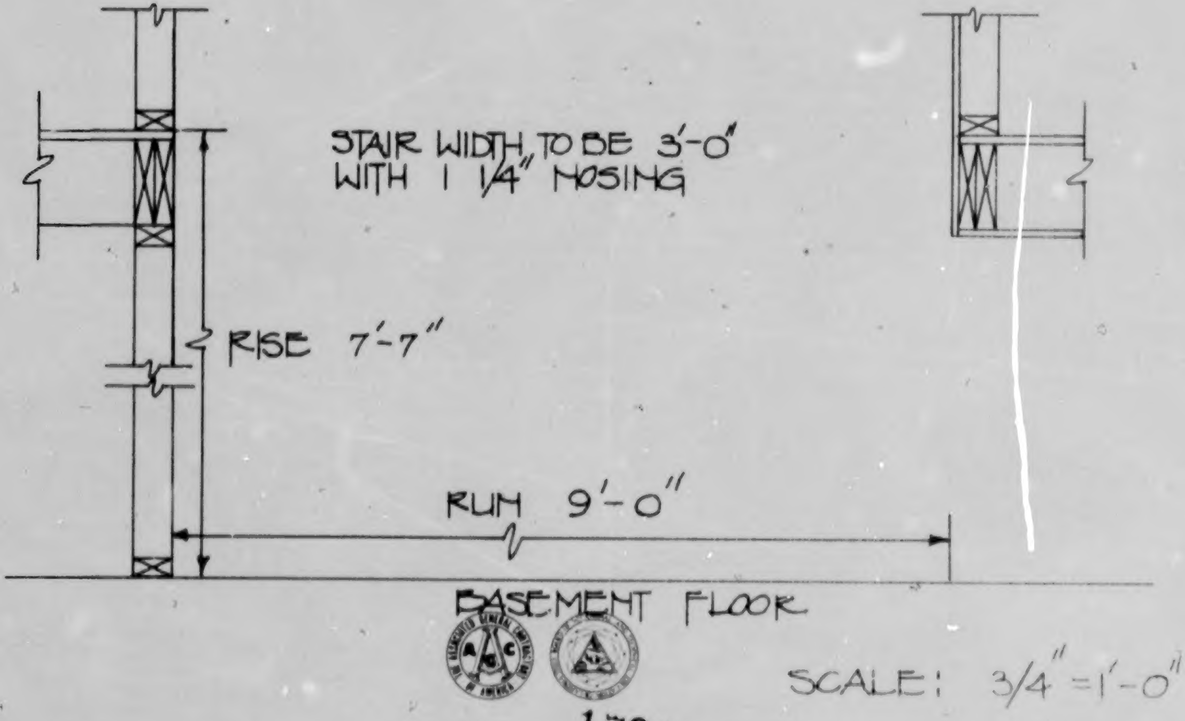
NAILED FROM REAR

STAIR CONSTRUCTION
UNIT I

ASSIGNMENT SHEET #1--MATERIAL ESTIMATING

Calculate the material needed to construct a housed stair to fit the stairwell pictured below. Use the information sheet, the framing square, and gauges provided by the instructor.

1. Number of stringers ______________________________
2. Stringer length ______________________________
3. Tread length ______________________________
4. Number of treads ______________________________
5. Riser length ______________________________
6. Number of risers ______________________________
7. Unit rise ______________________________
8. Unit run ______________________________
9. Material order
    a. Stringers (2 x 12) ______________________________
    b. Riser (1 x 8) ______________________________
    c. Treads (2 x 12) ______________________________


STAIR WIDTH TO BE 3'-0"
WITH 1 1/4" NOSING
RISE 7'-7"
RUN 9'-0"
BASEMENT FLOOR
SCALE: 3/4" = 1'-0"

STAIR CONSTRUCTION
UNIT I

ANSWERS TO ASSIGNMENT SHEET

1. 2
2. 14'
3. 3'
4. 12
5. 3'
6. 13
7. 7"
8. 9"
9. a. 2 - 2 x 12 x 14'
   b. 2 - 1 x 8 x 12'
      1 - 1 x 8 x 16'
   c. 3 - 2 x 12 x 12'

STAIR CONSTRUCTION
UNIT I

JOB SHEET #1--LAY OUT, CUT, AND ASSEMBLE A HOUSED STAIR

I. Tools and materials

  A. Tools

    1. Tape measure, 12 to 16 foot
    2. Framing square
    3. Electric handsaw
    4. Crosscut handsaw
    5. Level, 3 or 4 foot
    6. Claw hammer, 16 oz
    7. Stair gauge clamps

  B. Material

    1. 2 x 12's for stringers
    2. 2 x 12's for treads
    3. 1 x 8's for risers
    4. Baluster rail and brackets
    5. Nails
      a. 16d casing
      b. 16d box
      c. 8d box

II. Procedure

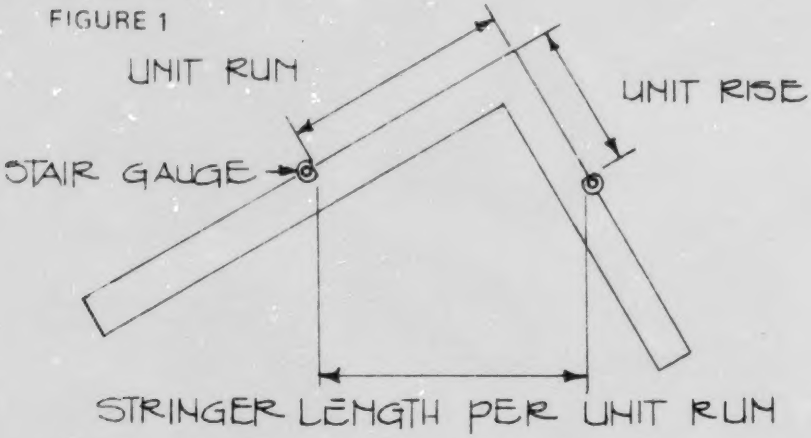
  A. Lay out stringers

    1. Determine the number of risers and treads
    2. Determine unit rise and unit run

JOB SHEET #1

3. Place stair gauge clamps on the framing square at the exact unit rise and unit run (Figure 1)

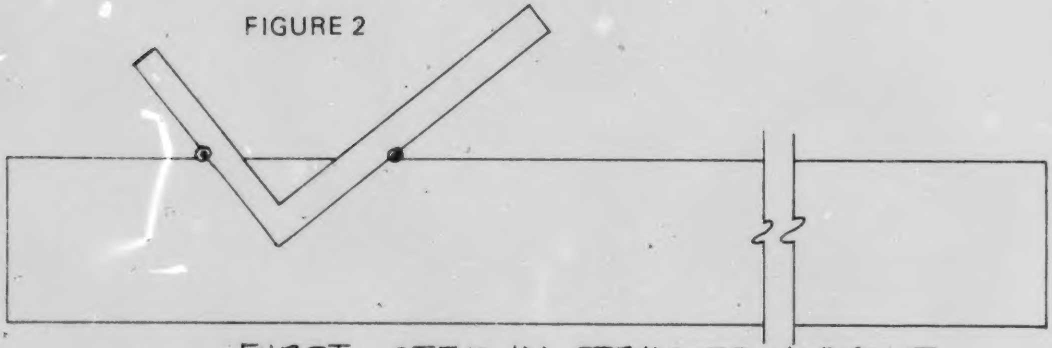
FIGURE 1


UNIT RUN
UNIT RISE
STAIR GAUGE
STRINGER LENGTH PER UNIT RUN

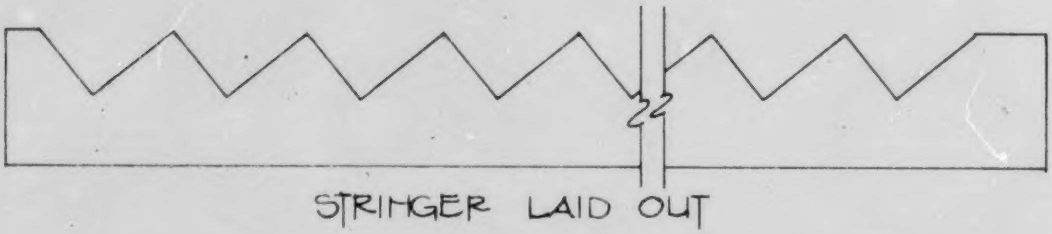
4. Lay out the tread and riser locations (Figure 2)

(NOTE: Marks must be exact.)

FIGURE 2



FIRST STEP IN STRINGER LAYOUT

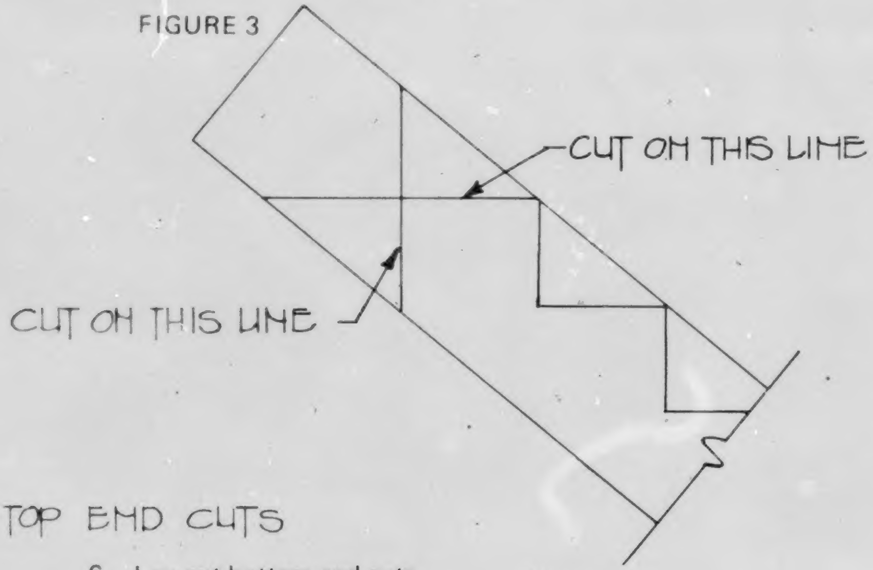


STRINGER LAID OUT

JOB SHEET #1

5. Lay out to cut top end (Figure 3)

FIGURE 3


CUT ON THIS LINE
CUT ON THIS LINE

TOP END CUTS

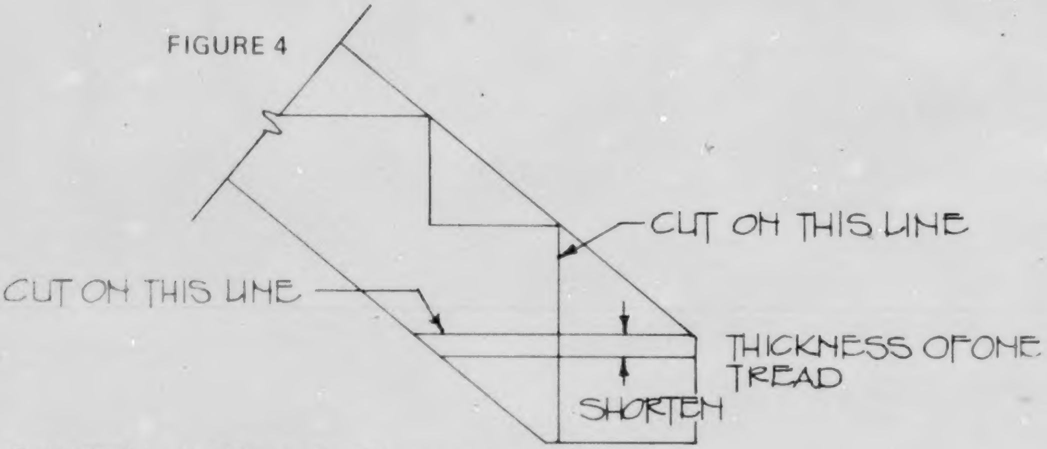
6. Lay out bottom end cuts

   a. Lay off as you would for the last riser

   b. Shorten the last unit rise by the thickness of the tread

   (NOTE: The last riser is shortened so that the first step up from the floor will be the same unit rise as the remainder of the steps. See Figure 4.)

FIGURE 4


CUT ON THIS LINE
CUT ON THIS LINE
THICKNESS OF ONE TREAD
SHORTEN

SHORTEN BOTTOM END CUTS

JOB SHEET #1

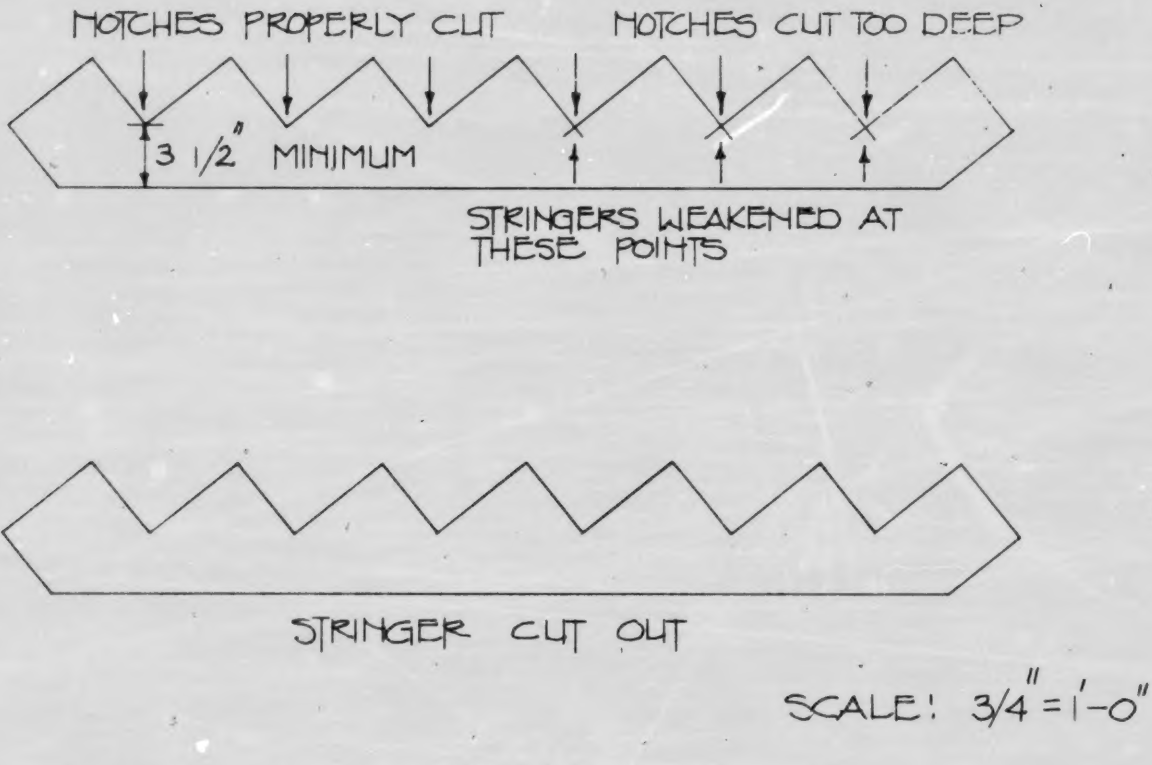
B. Cut out stringers (Figure 5)

1. Cut in to the point of each notch with the electric handsaw

   (NOTE: Do not saw past the point of each notch as this weakens the stringer; minimum of 3 1/2" should be left or unnotched.)

2. Finish each cut with the crosscut handsaw

FIGURE 5


NOTCHES PROPERLY CUT
NOTCHES CUT TOO DEEP
3 1/2" MINIMUM
STRINGERS WEAKENED AT THESE POINTS
STRINGER CUT OUT
SCALE: 3/4" = 1'-0"

C. Cut risers and treads to length and width

(NOTE: For stairs 8' or more, additional support should be considered.)

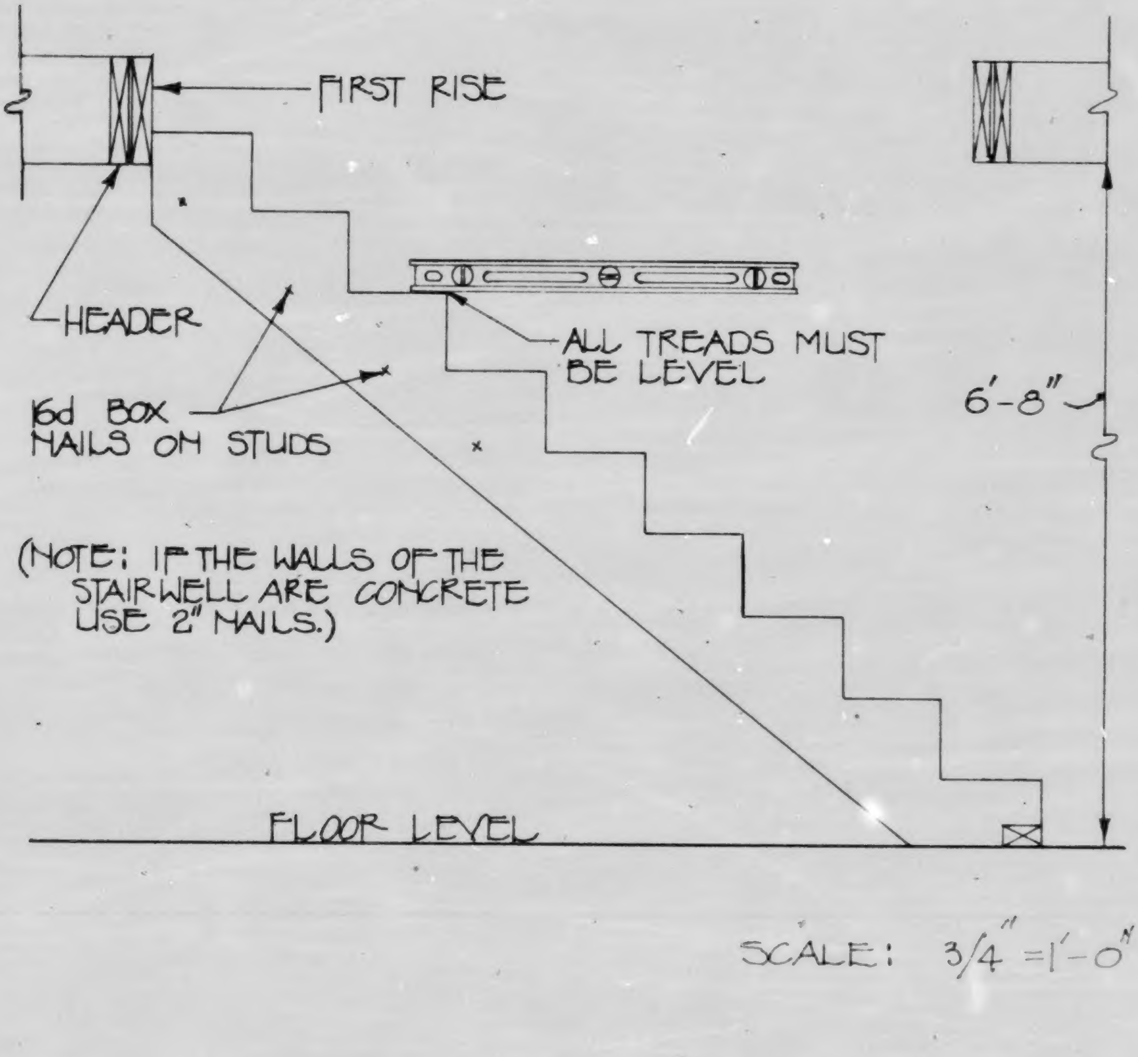
JOB SHEET #1

D. Assemble stair

1. Nail the stringers to the side walls of the stairwell (Figure 6)

   (NOTE: Stringers may also be nailed to a kicker at the bottom and nailed to the header at the top. May also use hangers, straps, or ledger strip. See Transparency 5. The stair treads must be level to prevent slipping.)

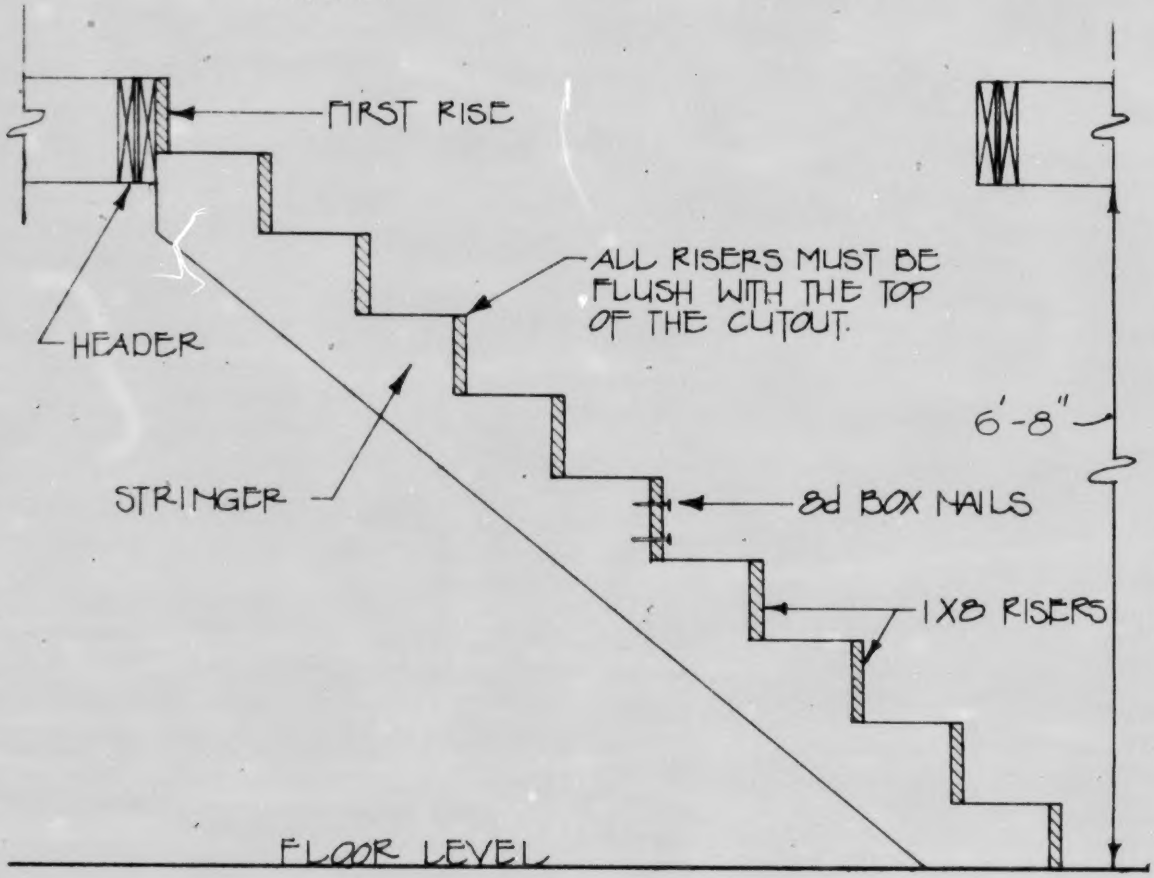
FIGURE 6


FIRST RISE
HEADER
ALL TREADS MUST BE LEVEL
16d BOX NAILS ON STUDS
6'-8"
(NOTE: IF THE WALLS OF THE STAIRWELL ARE CONCRETE USE 2" NAILS.)
FLOOR LEVEL
SCALE: 3/4" = 1'-0"

JOB SHEET #1

2. Nail risers in place first (Figure 7)

FIGURE 7

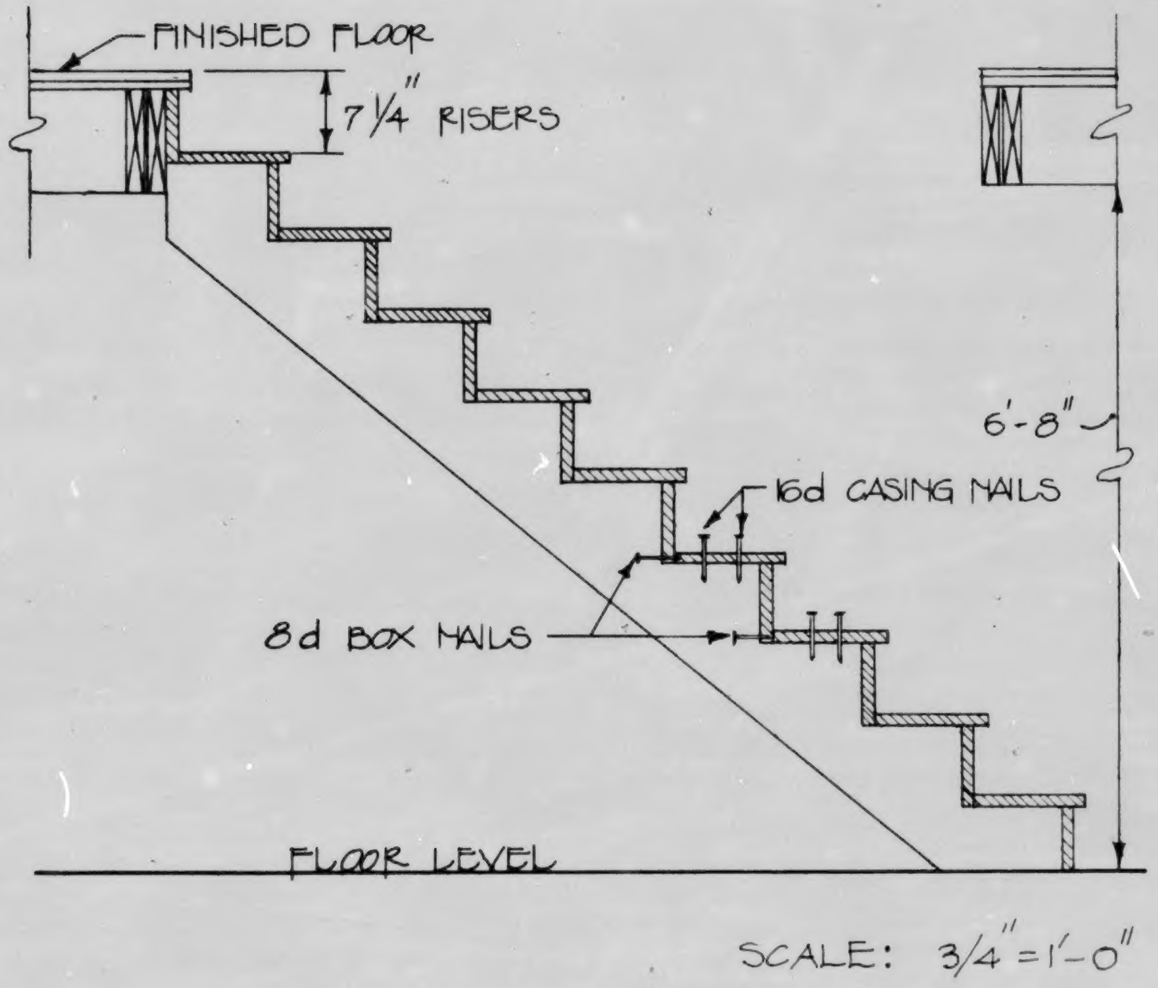

FIRST RISE
HEADER
ALL RISERS MUST BE FLUSH WITH THE TOP OF THE CUTOUT.
STRINGER
6'-8"
8d BOX NAILS
1X8 RISERS
FLOOR LEVEL

SCALE: 3/4" = 1'-0"

JOB SHEET #1

3. Nail the treads in place (Figure 8)

FIGURE 8


FINISHED FLOOR
7 1/4" RISERS
6'-8"
16d CASING NAILS
8d BOX NAILS
FLOOR LEVEL
SCALE: 3/4" = 1'-0"

4. Install the baluster rail

(NOTE: Follow the instructions that are included with the rail hardware.)

STAIR CONSTRUCTION
UNIT I

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______ a. Complete flight of steps leading from one floor or story to another above

______ b. That portion of a step on which the foot is placed when mounting the stairs

______ c. Staircase which has one side open to a room or hall

______ d. Upright support of the handrail for a stair

______ e. Upper or lower post which supports the handrail of a stair

______ f. Rail on a stair used for support; sometimes called a *baluster rail*

______ g. Compartment extending vertically through a building in which stairs are placed

______ h. Clear space between the tread of a stair and the ceiling above

______ i. Inclined supports of a flight of stairs

______ j. Distance between two landings

______ k. Staircase in which the stringers are housed between two walls

______ l. Horizontal distance from a point at the head of a stair to the outside end of the last riser

______ m. Platform introduced at some point to change the direction of the stairway or to break the run

______ n. Stair which has both sides open to a room or hall

1. Baluster
2. Head room
3. Handrail
4. Housed stair
5. Landing
6. Line of flight
7. Newel post
8. Nosing
9. Open stair
10. Rise
11. Riser
12. Run
13. Semihoused stair
14. Staircase
15. Stairwell
16. Stringer
17. Tread

______o. Angle of ascent of a stair

______p. Vertical distance under the edge of a stair tread which may be open or closed

______q. Rounded edge of a stair tread that projects over the riser

2. Identify the parts of a staircase in the illustration below. Write the correct numbers in the blanks provided.

______a. Headroom

______b. Landing

______c. Rise

______d. Run

______e. Tread

______f. Riser

______g. Stringer

______h. Unit rise

______i. Unit run

______j. Nosing piece

______k. Baluster

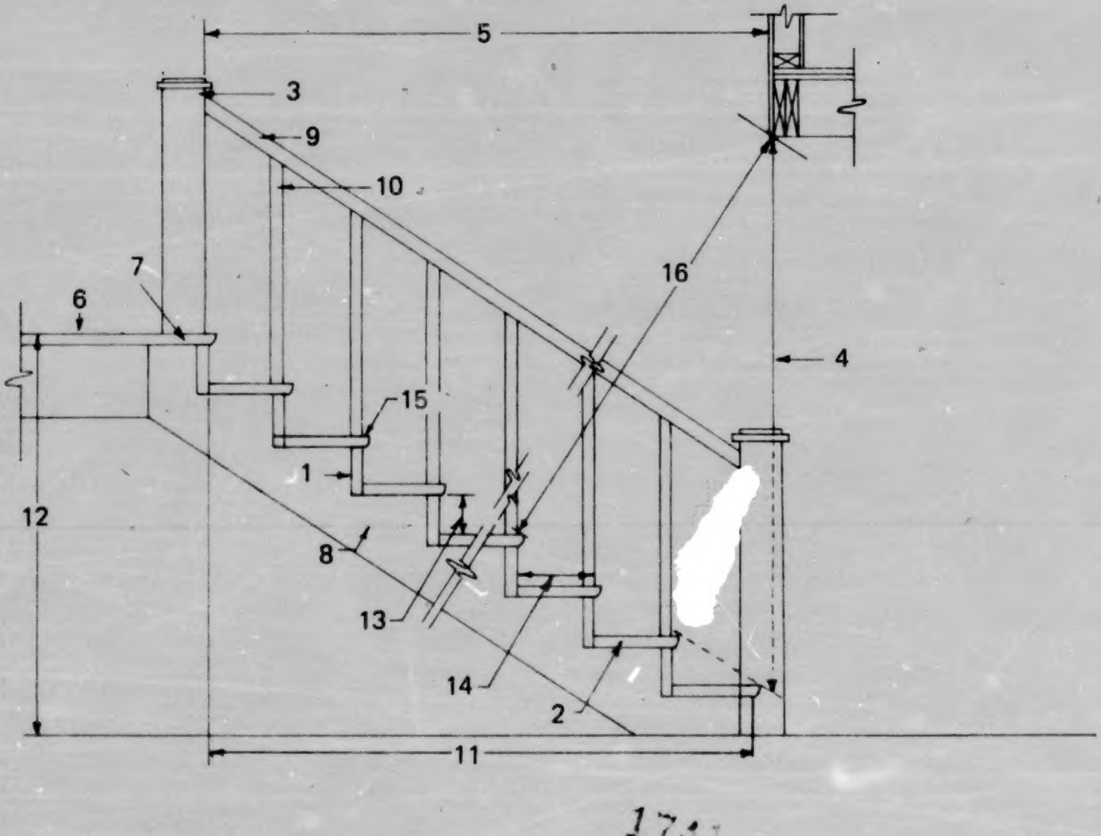
______l. Newel post

______m. Handrail or baluster rail

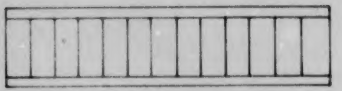
______n. Stairwell

______o. Clearance

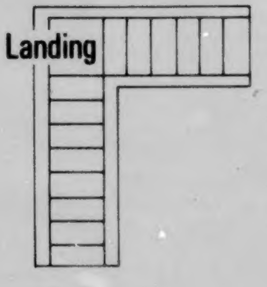
______p. Nosing



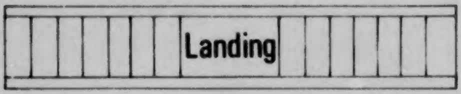
3. Identify the basic types of stairs pictured below.



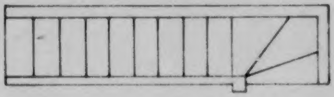
a. ____________________



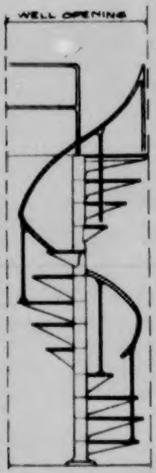
b. ____________________



c. ____________________

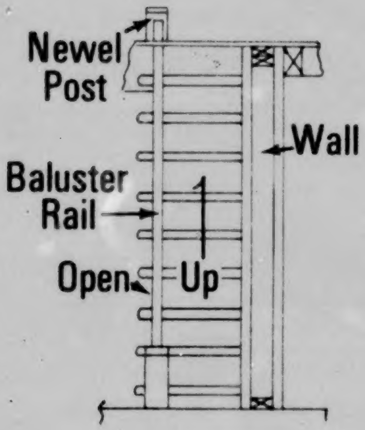


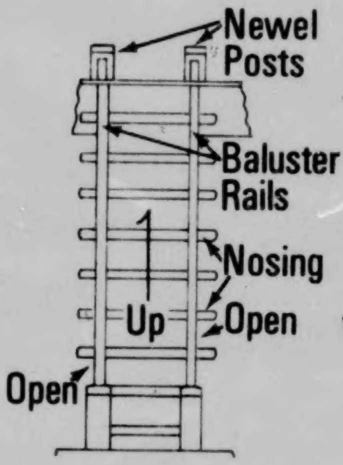
d. ____________________

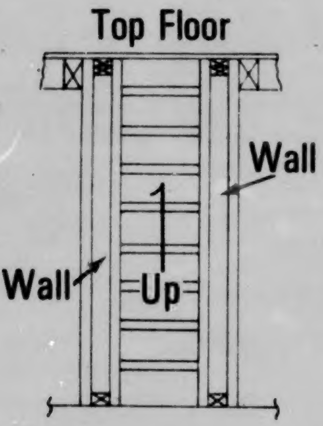

WELL OPENING

e. ____________________

4. Identify the ways stairs are fitted into the building.


Newel
Post
Wall
Baluster
Rail
Open
Up


Newel
Posts
Baluster
Rails
Nosing
Open
Up
Open


Top Floor
Wall
Wall
Up

a. ______________ b. ______________ c. ______________

5. State the rule of thumb for unit run and unit rise.

____

____

____

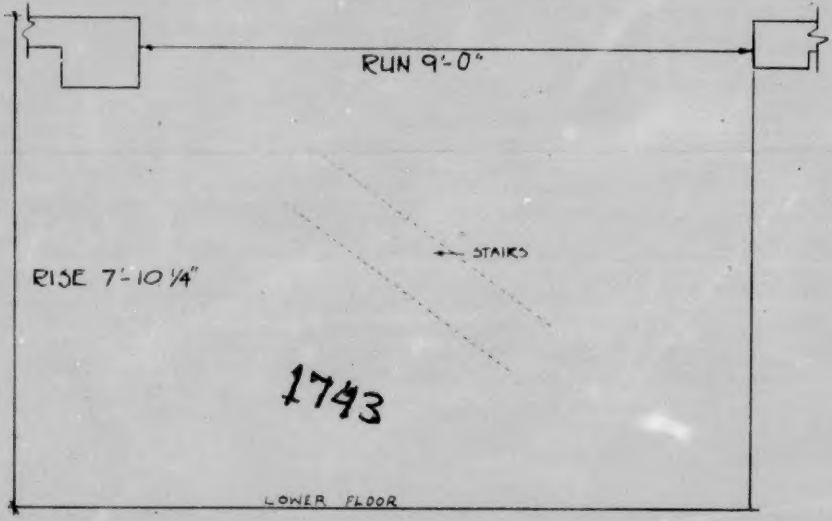
____

6. Calculate the number of risers and the number of treads for the stair pictured below.

_____ a. Risers

_____ b. Treads

STRINGER LENGTH PER
UNIT RUN = 12"
STAIR WIDTH 3'-0"


RUN 9'-0"
STAIRS
RISE 7'-10 1/4"
1743
LOWER FLOOR

7. List the factors that must be considered in building a staircase.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

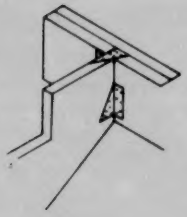
8. Estimate the following materials for the housed stair in question number six.

a. __________ - 2 x 12 x __________ for stringers
number length

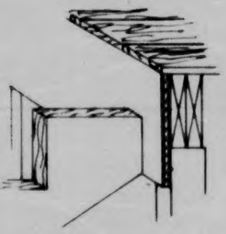
b. __________ - 2 x 12 x __________ for treads
number length

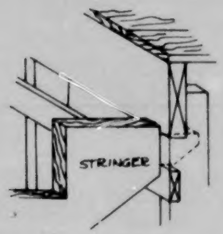
c. __________ - 1 x 8 x __________ for risers
number length

9. Identify methods of securing stringers.



a. ____________________





b. ____________________ c. ____________________

10. Demonstrate the ability to lay out, cut, and assemble a housed stair.

(NOTE: If this has not been accomplished prior to the test, ask the instructor when the above activity should be completed.)

STAIR CONSTRUCTION
UNIT I

ANSWERS TO TEST

1. a. 14
   b. 17
   c. 13
   d. 1
   e. 7
   f. 3
   g. 15
   h. 2
   i. 16
   j. 10
   k. 4
   l. 12
   m. 5
   n. 9
   o. 6
   p. 11
   q. 8

2. a. 4
   b. 6
   c. 12
   d. 11
   e. 2
   f. 1
   g. 8
   h. 13
   i. 14
   j. 7
   k. 10
   l. 3
   m. 9
   n. 5
   o. 16
   p. 15

3. a. Straight flight
   b. L-shaped
   c. Straight flight with landing
   d. Winder
   e. Circular

DOOR HANGING AND TRIM
UNIT II

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the parts of an interior door unit, name the types of interior door construction, and identify the hand of a door. The student should also be able to measure, cut, and install casing; hang a door; install a prehung door unit; and estimate materials needed to trim a room. This knowledge will be evidenced by completion of the assignment sheet, job sheets, and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with door hanging and trim to the correct definitions.
2. Identify the parts of an interior door unit.
3. Name general types of interior door construction.
4. Identify the hand of a door.
5. State the standard dimensions of interior doors and frames.
6. Identify the parts of a window installation.
7. Identify types of joints commonly used to install casing and trim.
8. Identify types of molding.
9. Identify types of doors according to installation.
10. Estimate the material needed to trim a room.
11. Demonstrate the ability to:
    a. Install interior door frame, hang door, lock, and trim.
    b. Case a window.
    c. Case a door frame.
    d. Install a prehung door unit.

DOOR HANGING AND TRIM
UNIT II

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information, assignment, and job sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information and assignment sheets.

  F. Demonstrate and discuss procedures outlined in job sheets.

  G. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Parts of an Interior Door Unit
    2. TM 2--Parts of an Interior Door Unit (Continued)
    3. TM 3--Types of Interior Door Construction
    4. TM 4--Hand of a Door
    5. TM 5--Parts of a Window Installation
    6. TM 6--Common Trim and Molding Joints
    7. TM 7--Molding
    8. TM 8--Types of Doors According to Installation
    9. TM 9--Types of Doors According to Installation (Continued)

  D. Assignment Sheet #1--Material Estimating

  E. Answers to assignment sheet

F. Job sheets

  1. Job Sheet #1--Install Interior Door Frame, Hang Door, Lock, and Trim
  2. Job Sheet #2--Case a Window
  3. Job Sheet #3--Case a Door Frame
  4. Job Sheet #4--Install a Prehung Door Unit

G. Test

H. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago: American Technical Society, 1955.

B. Cooper, George H., and Badzinski, Stanley Jr. *Building and Construction Estimating*. New York: McGraw-Hill, 1971.

C. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry*. 3rd ed. Chicago: Illinois: American Technical Society, 1963.

D. Smith, Ronald C. *Principles and Practices of Light Construction*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

E. Wagner, Willis H. *Modern Carpentry*. Homewood, Illinois: Goodheart-Willcox, 1976.

F. Wilson, Douglas J. *Practical House Carpentry*. New York: McGraw-Hill Book Company, Inc.. 1957.

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DOOR HANGING AND TRIM
UNIT II

INFORMATION SHEET

I. Terms and definitions

A. Apron--Piece of trim placed horizontally under the stool

B. Baseboard--Finishing board covering the edge of the wallboard where the wall and floor meet

C. Base shoe--Small narrow molding used around a room at the base of the baseboard

D. Butt--Type of door hinge where one leaf is mortised into the edge of the door and the other leaf is mortised into the side jamb

E. Casing--Framework of trim around a window or door

F. Clearance--Spacing between the edge of a door and the jamb

G. Cope--To cut or shape the end of a piece of molding so it will cover and fit the contour of an adjoining piece of molding

H. Cove molding--Molding with a concave profile used primarily for trim where the wall meets the ceiling

I. Door frame--Assembly of wood parts that form an enclosure and support for a door

J. Gain--Notch or mortise cut to receive a hinge or other hardware

K. Head jamb--Top member of a door frame

L. Jig--Contrivance used for guiding tools while work is being done

M. Miter joint--Ends of any two pieces of board of corresponding shape cut off at an angle and fitted together in an angular shape

N. Quarter round--Type of molding which presents a profile of a quarter of a circle

O. Side jamb--Vertical side posts of a door frame

P. Stool--Base or support at the bottom of a window that extends into the room

Q. Template--Gauge which is used as a guide for forming or shaping

INFORMATION SHEET

R. Threshold--Wood or metal member used to close the space at the bottom of a door at the sill

S. Trim--Visible finishing work in a building

T. Reveal--That part of a jamb between edge of jamb and trim; usually 3/8"

II. Parts of an interior door unit (Transparencies 1 and 2)

A. Side jambs

B. Head jamb

C. Blocking

D. Door

E. Casing

F. Door stop

G. Rough header

H. Trimmer stud

I. Butts

J. Lockset

K. 45° miter joint

III. General types of interior door construction (Transparency 3)

A. Solid core

B. Hollow core

IV. Hand of a door (Transparency 4)

(NOTE: When installing locks, the hand of a door is determined by facing the door from the outside of the building for exterior doors and from the security side for interior doors.)

A. Right hand (RH)

(NOTE: The butts are to your right and the door swings away from you.)

B. Left hand (LH)

(NOTE: The butts are to your left and the door swings away from you.)

INFORMATION SHEET

C. Right hand reverse (RHR)

(NOTE: The butts are to your right and the door swings toward you.)

D. Left hand reverse (LHR)

(NOTE: The butts are to your left and the door swings toward you.)

V. Dimensions of interior doors and frames

A. Standard interior door sizes

(NOTE: Door sizes are always given in this order: thickness, width, and height, such as 1 3/8" x 2'-8" x 6'-8".)

1. Thickness--1 3/8"

   (NOTE: This is standard unless otherwise specified.)

2. Width

   a. 2'-0"

   b. 2'-4"

   c. 2'-6"

   d. 2'-8"

   e. 3'-0"

3. Height--6'-8"

   (NOTE: This is standard unless otherwise specified.)

B. Standard interior jamb sizes

(NOTE: Interior jambs are specified by the door width, length, and the thickness of the finished wall, as 2'-8" x 6'-8" x 4 1/2" interior jamb.)

1. Width

   (NOTE: If the opening is greater than 2'-8", an extra side jamb may be cut to the correct length and used as a head jamb.)

   a. 2'-0"

   b. 2'-4"

INFORMATION SHEET

c. 2'-6"

d. 2'-8"

e. 3'-0"

2. Length--6'-8"

(NOTE: This length is standard unless otherwise specified.)

3. Thickness--4 1/2"

(NOTE: This thickness is standard for a 2 x 4 stud wall with 1/2" gypsum wallboard on both sides. If paneling is used over the wallboard, the jambs will need to be specially ordered or made on the job.)

C. Casing--May be purchased precut to the jamb size or in random lengths of odd and even feet to be cut on the job

D. Door stop--May be purchased precut to the jamb size or in random lengths of odd and even feet to be cut on the job

VI. Parts of a window installation (Transparency 5)

A. Window unit

B. Head jamb

C. Side jamb

D. Stool

E. Casing

F. Apron

VII. Types of joints commonly used to install casing and trim (Transparency 6)

A. Miter

(NOTE: A miter joint is used on outside corners and is usually forty-five degrees but may be greater or less depending on the corner.)

B. Coped

(NOTE: A coped joint is used on inside corners and may be cut to fit almost any inside angle.)

INFORMATION SHEET

VIII. Types of molding (Transparency 7)

- A. Casing
- B. Baseboard
- C. Door and window stops
- D. Quarter round
- E. Base shoe
- F. Cove
- G. Bed
- H. Corner

IX. Types of doors according to installation (Transparencies 8 and 9)

- A. Swinging
- B. Bypass
- C. Bifold
- D. Pocket
- E. Multifold

X. Material estimating

- A. Doors
  - 1. Type
  - 2. Size
  - 3. Number of each
- B. Jamb sets
  - 1. Size
  - 2. Number of sets of each size
- C. Casing--Sets or lineal feet
  - 1. Sets for specific door sizes
  - 2. Lineal feet for windows, odd size openings, and aprons

INFORMATION SHEET

D. Butts--Pairs

   1. Size
   2. Number of pairs

E. Baseboard--Lineal feet

(NOTE: Order enough to go around the perimeter of the room and inside closets.)

F. Door stop--Sets

   1. Sizes
   2. Number of sets for each size

G. Base shoe--Lineal feet

(NOTE: Order the same amount of base shoe as baseboard.)

H. Window jambs and sills

(NOTE: Order one board foot of the type of lumber specified for each foot or part of a foot of area around a window.)

I. Locksets

   1. Type
      a. Passageway (bedrooms)
      b. Privacy (bathrooms)
      c. Keyed (entrance)
   2. Style
   3. Brand
   4. Number of each

J. Other trim--Lineal feet as needed

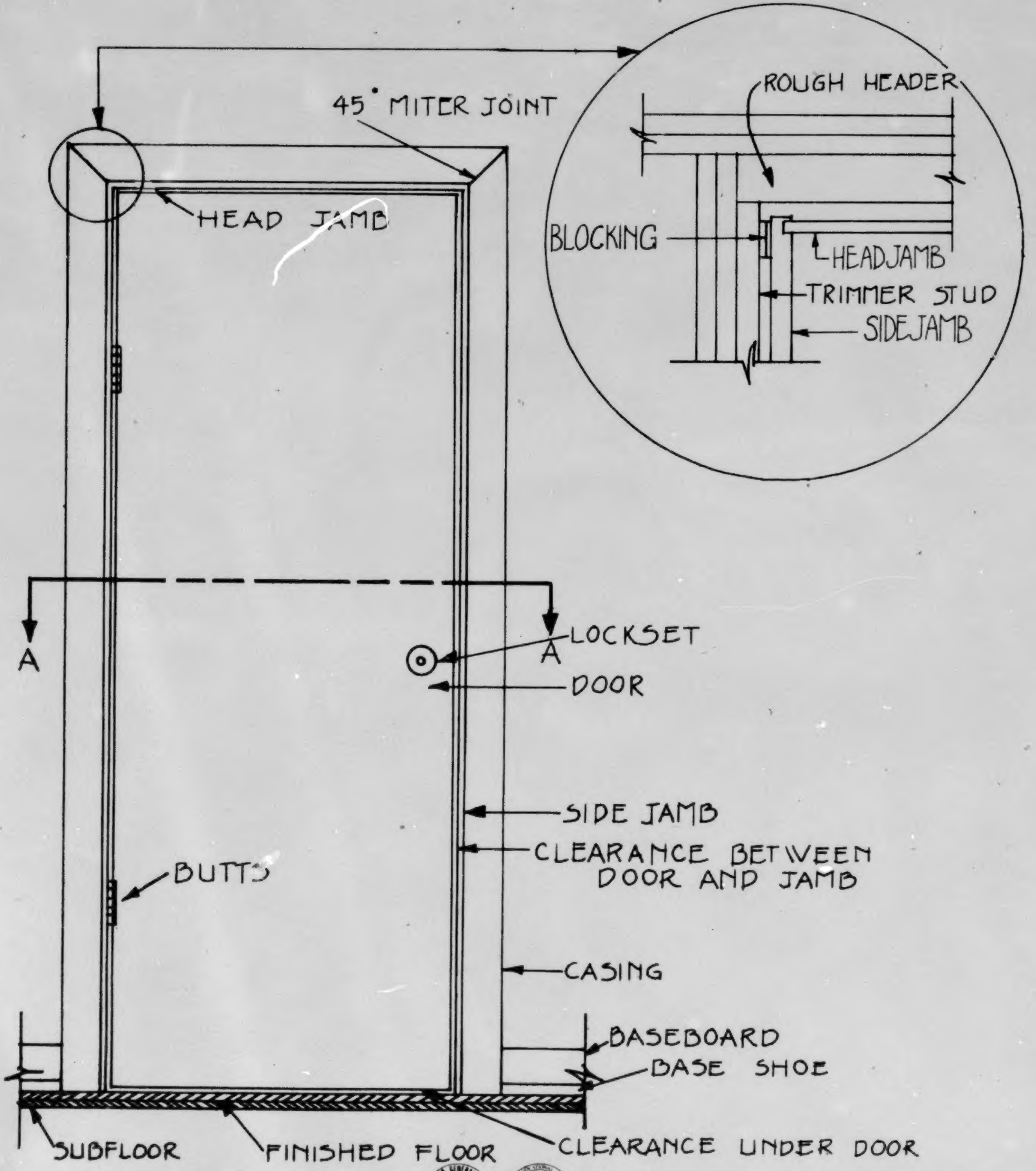
   1. Outside corners
   2. Cove molding
   3. Bed molding
   4. Quarter round

INFORMATION SHEET

K. Nails

1. Door frames, 8d casing, 1/5 lb per frame
2. Door trim, 6d finish, 1/2 lb per opening
3. Window trim, 6d finish, 1/4 lb per side
4. Baseboard, 6d finish, 1 lb per 100 lin ft
5. Base shoe, 2 lb per 1,000 lin ft

Parts of an Interior Door Unit


45° MITER JOINT
HEAD JAMB
ROUGH HEADER
BLOCKING
HEADJAMB
TRIMMER STUD
SIDEJAMB
A
A
LOCKSET
DOOR
SIDE JAMB
CLEARANCE BETWEEN DOOR AND JAMB
BUTTS
CASING
BASEBOARD
BASE SHOE
SUBFLOOR
FINISHED FLOOR
CLEARANCE UNDER DOOR
SCALE: 1"=1'-0"

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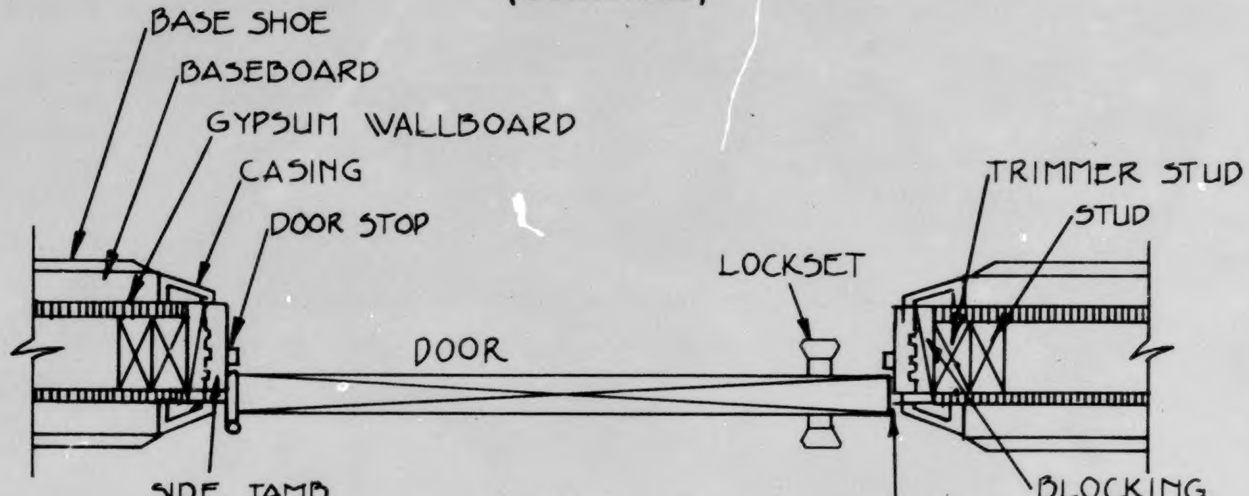
Parts of an Interior Door Unit

(Continued)


BASE SHOE
BASEBOARD
GYPSUM WALLBOARD
CASING
DOOR STOP
TRIMMER STUD
STUD
LOCKSET
DOOR
SIDE JAMB
BLOCKING
CLEARANCE

SECTION AA

NOTE: TRIM IS FACTORY
APPLIED TO BOTH SIDES
OF JAMB

SCALE: 1½" = 1'-0"

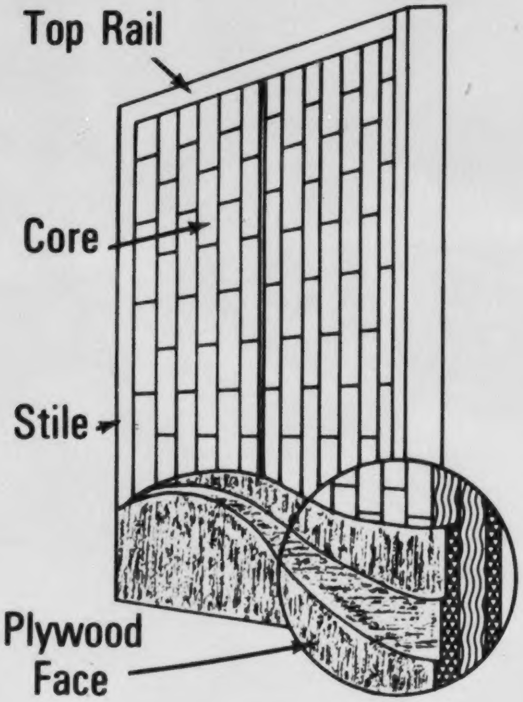
TM 2

1458

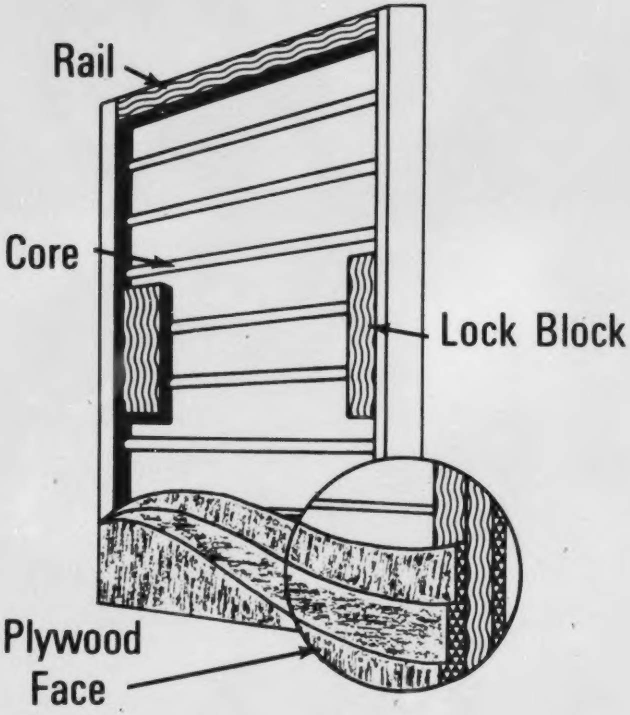
CC-6-K

1757

Types of Interior Door Construction


Top Rail
Core
Stile
Plywood Face

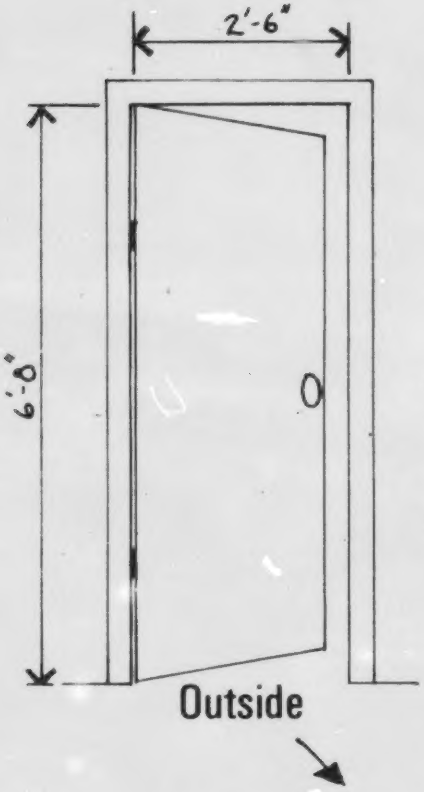
SOLID CORE


Rail
Core
Lock Block
Plywood Face

HOLLOW CORE

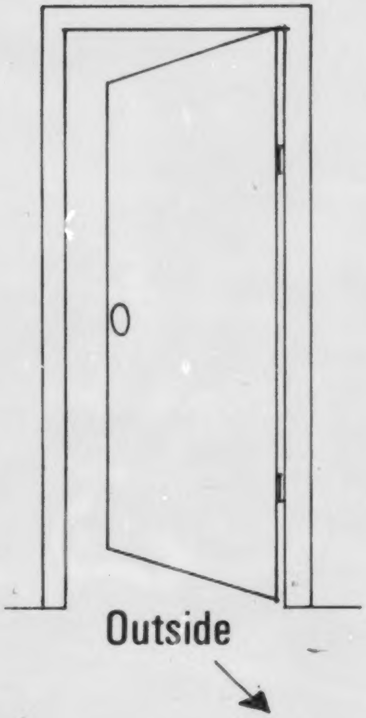
Hand of a Door

SCALE: ½" = 1'-0"


2'-6"
6'-8"
Outside

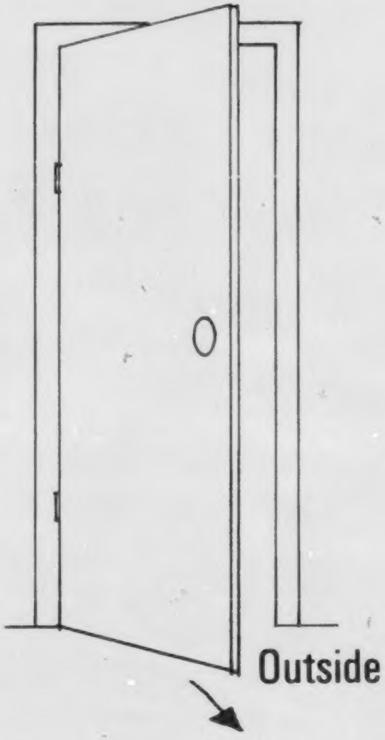
Left Hand

Hinges on Left;
Opens Inward for
Handed Locks;
Specify LH.



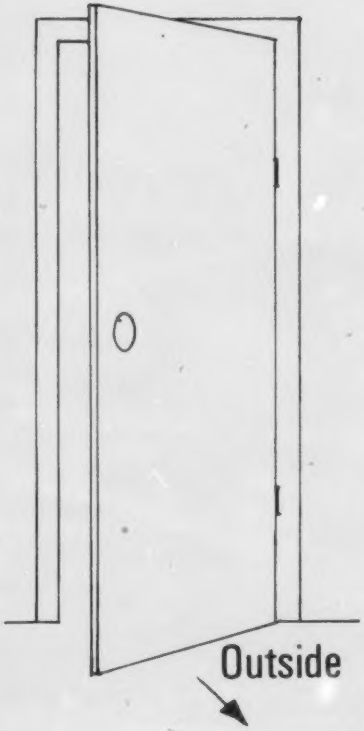
Right Hand

Hinges on Right;
Opens Inward for
Handed Locks;
Specify RH.



Left Hand Reverse

Hinges on Left;
Opens Outward for
Handed Locks;
Specify LHR.



Right Hand Reverse

Hinges on Right;
Opens Outward for
Handed Locks;
Specify RHR.

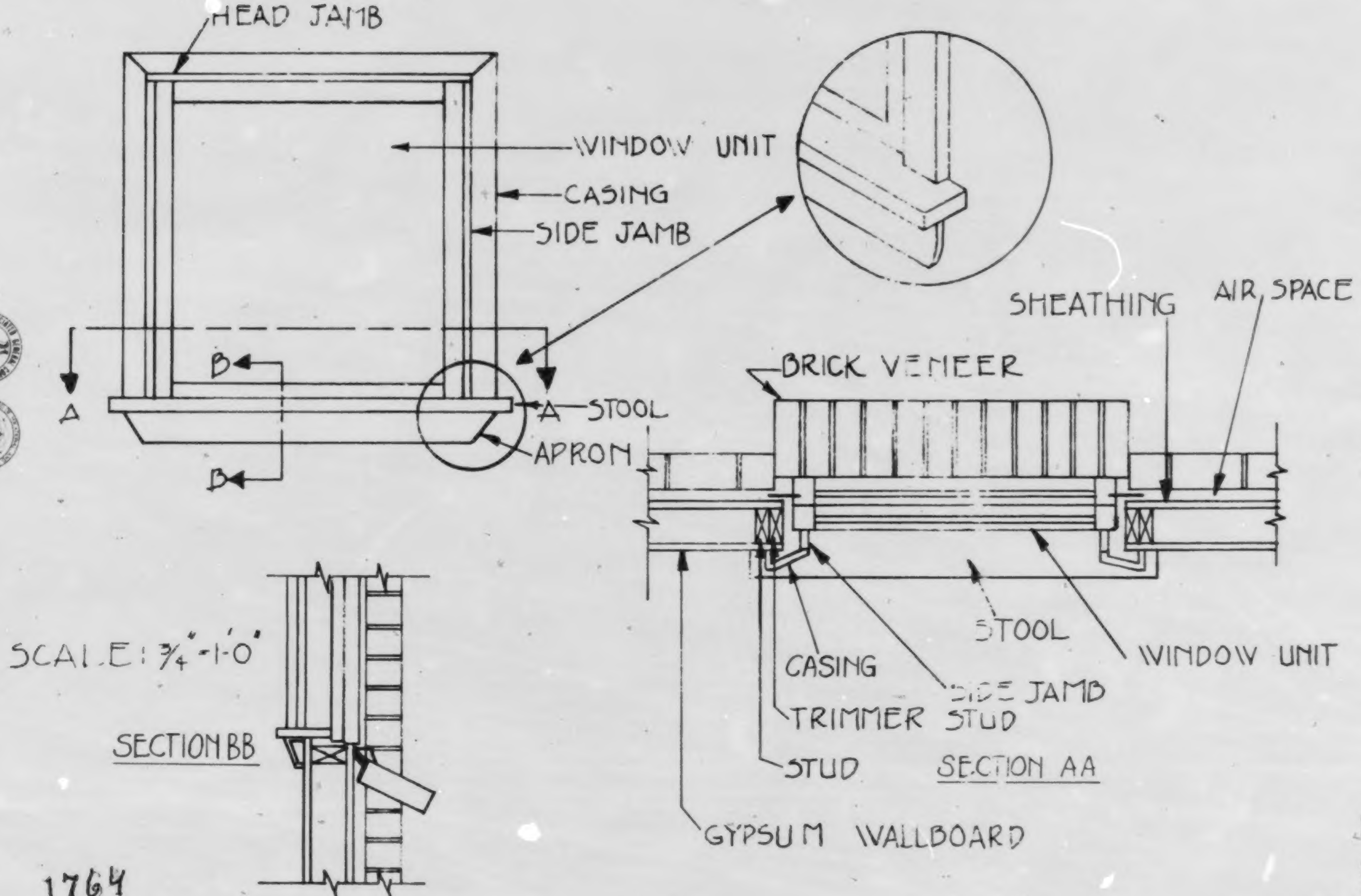
TM 4

1762

1763

CC-65-K

Parts of a Window Installation


HEAD JAMB
WINDOW UNIT
CASING
SIDE JAMB
A
B
A
STOOL
APRON
B
SHEATHING
AIR SPACE
BRICK VENEER
STOOL
WINDOW UNIT
CASING
SIDE JAMB
TRIMMER STUD
STUD
SECTION AA
GYPSUM WALLBOARD
SCALE: 3/4"-1'-0"
SECTION BB

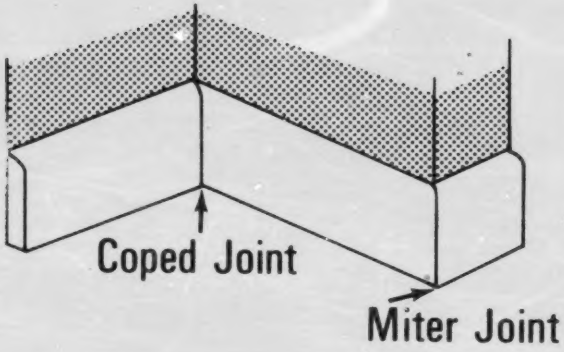
TM 5

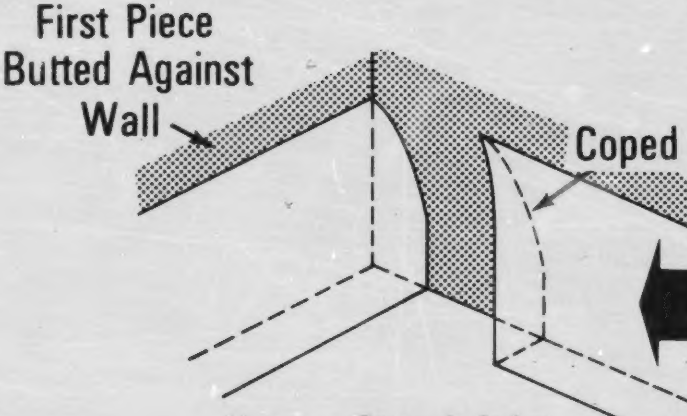
1764

CC 67 K

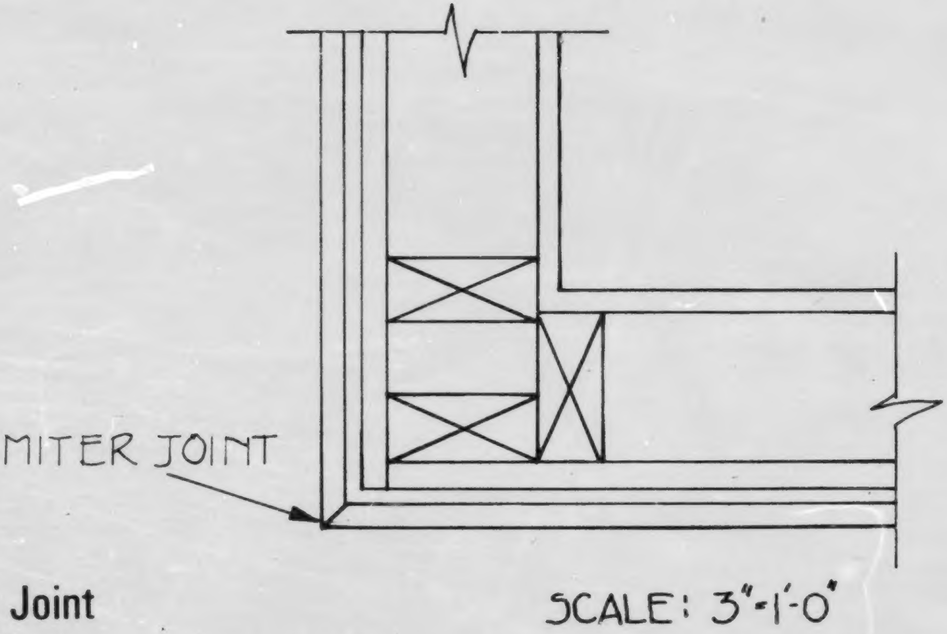
1765

Common Trim and Molding Joints


Coped Joint
Miter Joint


First Piece Butted Against Wall
Coped Joint

How a Coped Joint Fits Together


MITER JOINT
SCALE: 3"=1'-0"

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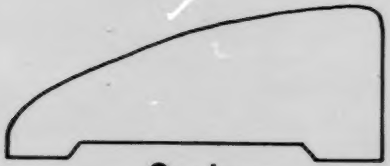
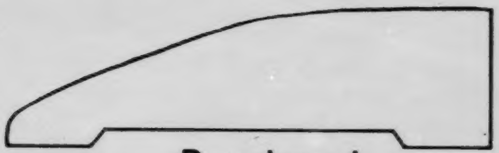
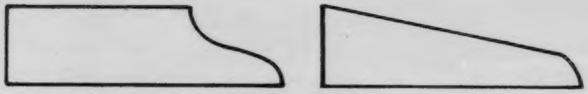
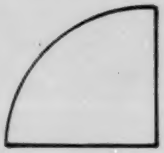
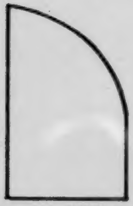
Molding

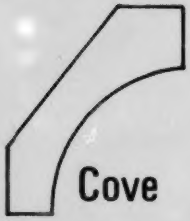

Casing

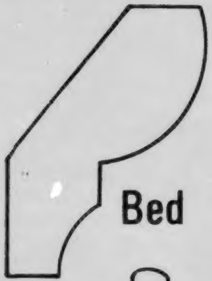

Baseboard

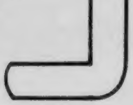

Door and Window Stops


Quarter Round


Base Shoe


Cove

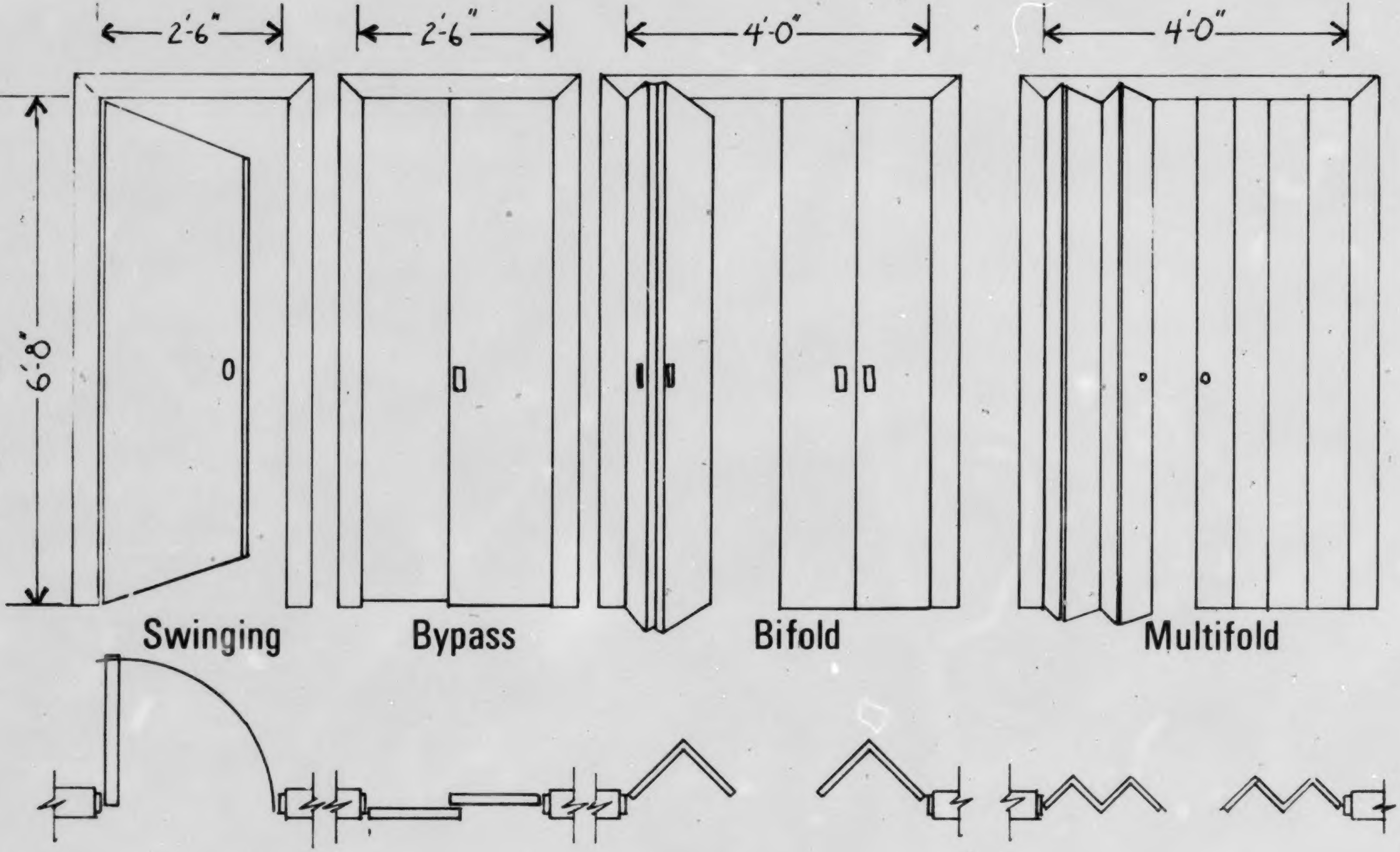

Bed


Corner

TM 7

1768

Types of Doors According to Installation


2'-6"
2'-6"
4'-0"
4'-0"
6'-8"
Swinging
Bypass
Bifold
Multifold

TM 8

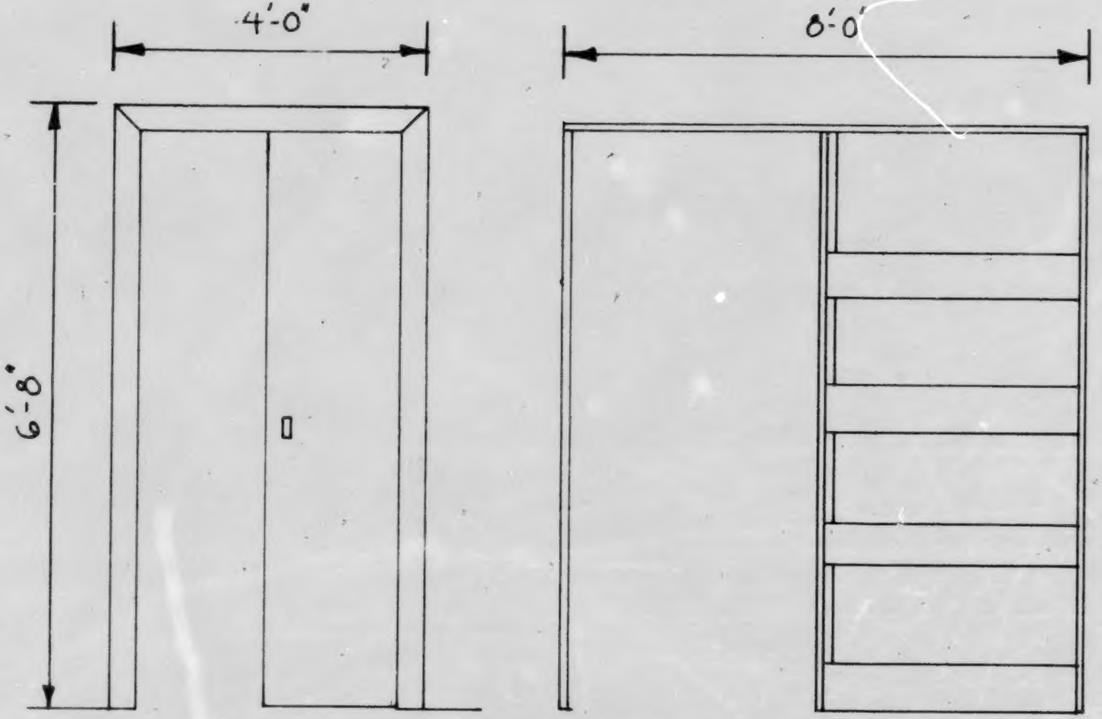
CC-73-K

1769

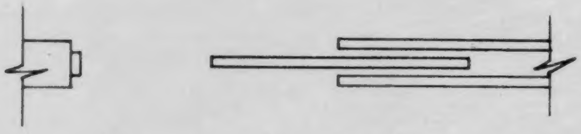
1770

Types of Doors According to Installation

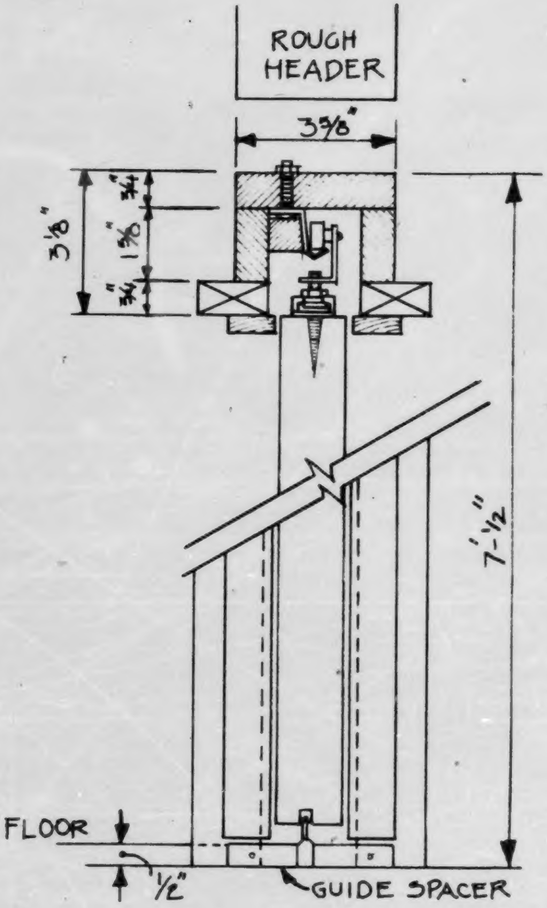
(Continued)



Pocket



SCALE: 1/2" = 1'-0"

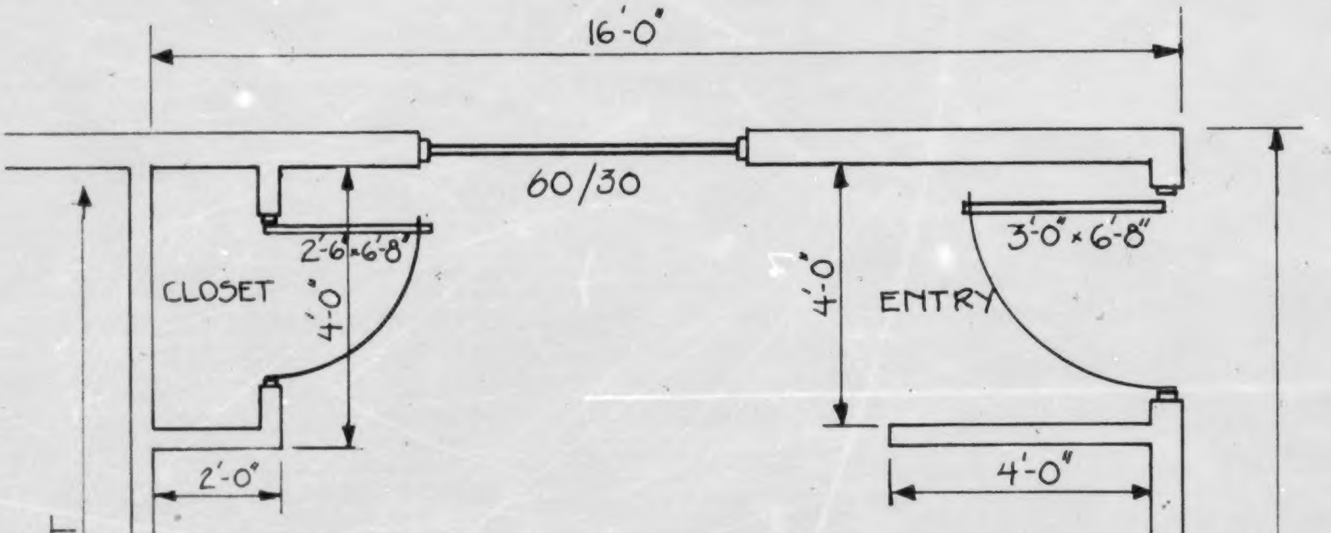

ROUGH HEADER
3 5/8"
3 1/8"
3/4"
1 5/8"
3/4"
7'-1/2"
FINISH FLOOR
1/2"
GUIDE SPACER

SCALE: 1/4 FULL SIZE

DOOR HANGING AND TRIM
UNIT II

ASSIGNMENT SHEET #1--MATERIAL ESTIMATING

Using the information sheet, calculate the door and trim materials for the room illustrated below. Space for your answers has been left on the next page.


16'-0"
60/30
2'-6"×6'-8"
CLOSET
4'-0"
4'-0"
ENTRY
3'-0"×6'-8"
2'-0"
4'-0"
FULL PANELING
CEILING JOIST
30/30
13'-6"
2'-8"×6'-8"
SCALE: 3/8"=1'-0"

ASSIGNMENT SHEET #1

a. Interior doors--

b. Interior door jambs--

c. Casing--

d. Door stop--

e. Butts (interior)--

f. Baseboard--

g. Base shoe--

h. Locksets (interior)--

DOOR HANGING AND TRIM
UNIT II

ANSWERS TO ASSIGNMENT SHEET

a. 1 - 2'-8" x 6'-8"
1 - 2'-6" x 6'-8"

b. 1 - 2'-6" x 6'-8"
1 - 2'-8" x 6'-8"

c. 2 sets of 2'-6" x 6'-8"
1 set of 2'-8" x 6'-8"
1 set of 3'-0" x 6'-8"
2 pieces of casing 10' long and 1 piece 14' long

d. 1 set of 2'-8" x 6'-8"
1 set of 2'-6" x 6'-8"

e. 2 pair of 3 1/2" butts

f. 76 lineal feet of baseboard

g. 76 lineal feet of base shoe

h. 2 passage locksets

DOOR HANGING AND TRIM
UNIT II

JOB SHEET #1--INSTALL INTERIOR DOOR FRAME, HANG DOOR, LOCK, AND TRIM

I. Tools and materials

A. Tools

1. Levels, 24" and 78"
2. Framing square
3. Claw hammer, 13 oz
4. Tape, 12' or 16'
5. Electric hand drill, 3/8"
6. Wood chisels, set
7. Router with mortising bits
8. Door hanging kit
9. Boring jig
10. Nail sets
11. Block plane
12. Jointer or power plane
13. Screwdriver, regular and phillips
14. Utility knife
15. Sand paper
16. Butt gauge
17. Handsaw, 10 point
18. Door jack
19. Miter box and saw
20. Butt marker

JOB SHEET #1

B. Materials

1. Door frame
2. Butt hinges
3. Shim shingles
4. Door
5. Lockset
6. Nails
    a. 4d finish
    b. 6d finish
    c. 8d finish or casing
7. Door stops
8. Casing

II. Procedure

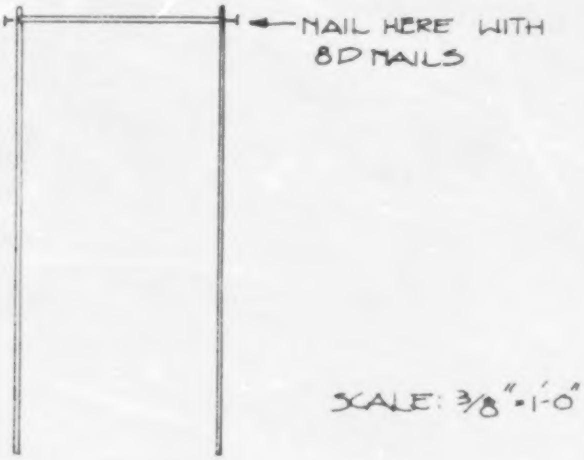
A. Assemble jamb

1. Cut jamb header to length

    (NOTE: Allow for dado cuts on jamb legs and add 1/8" to door width.)

2. Fit and nail jamb together using 8d nails (Figure 1)

FIGURE 1



JOB SHEET #1

(NOTE: Jamb legs are usually 81 1/4".)

3. Set jamb in opening

B. Set jamb

1. Determine the swing of door from plans

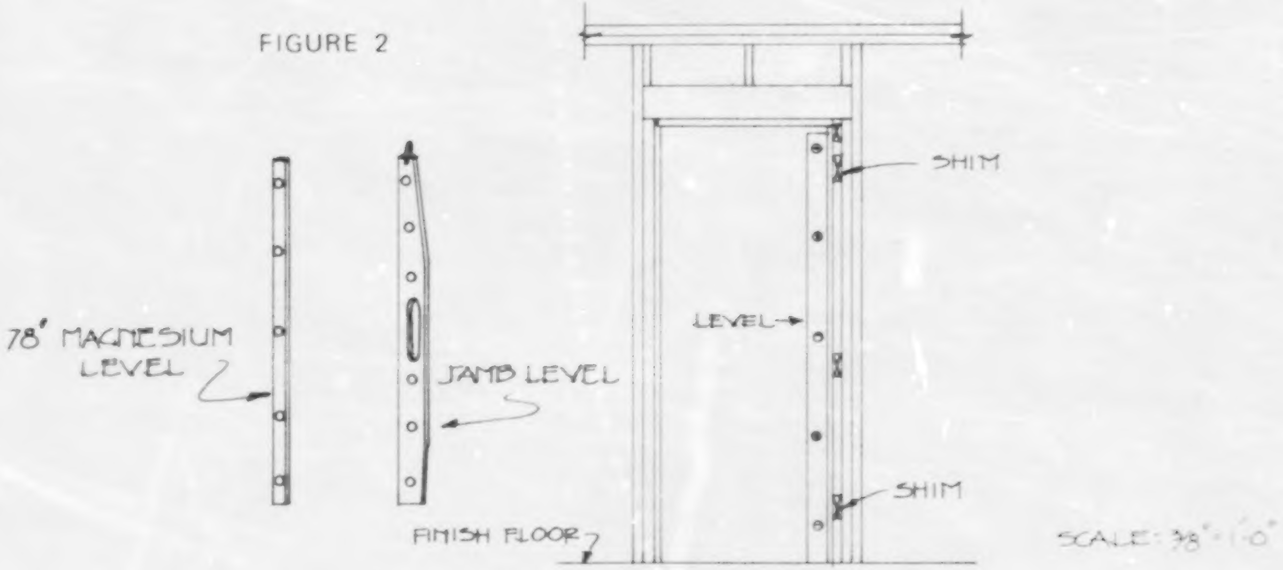
2. Check header for square and level with jamb in opening

   (NOTE: If necessary, adjust by trimming off one of jamb legs.)

3. Plumb hinge side of jamb by placing shims behind hinge locations (Figure 2)

   (NOTE: Hinge location is 7" down from top and 11" up from bottom.)

FIGURE 2



4. Use 78" level on hinge side to place intermediate shingles behind side jambs wherever needed

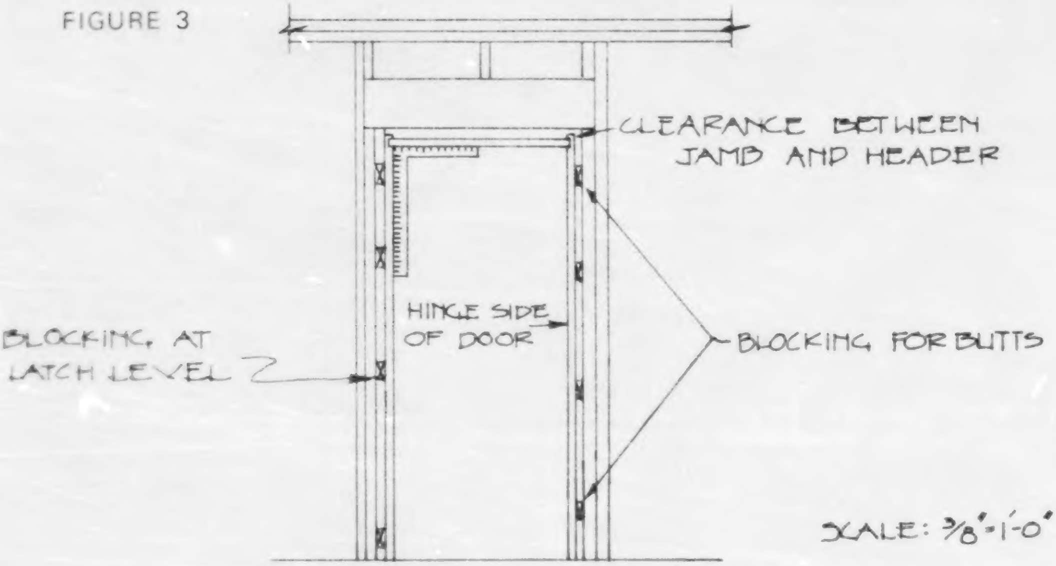
   (NOTE: This is necessary for rigidity and straightness.)

5. Use 8d finish or casing nails to set jamb

   (NOTE: Be sure edges of jamb line up with finish wall. When shimming keep jamb straight in opening. See Figure 3.)

JOB SHEET #1

FIGURE 3

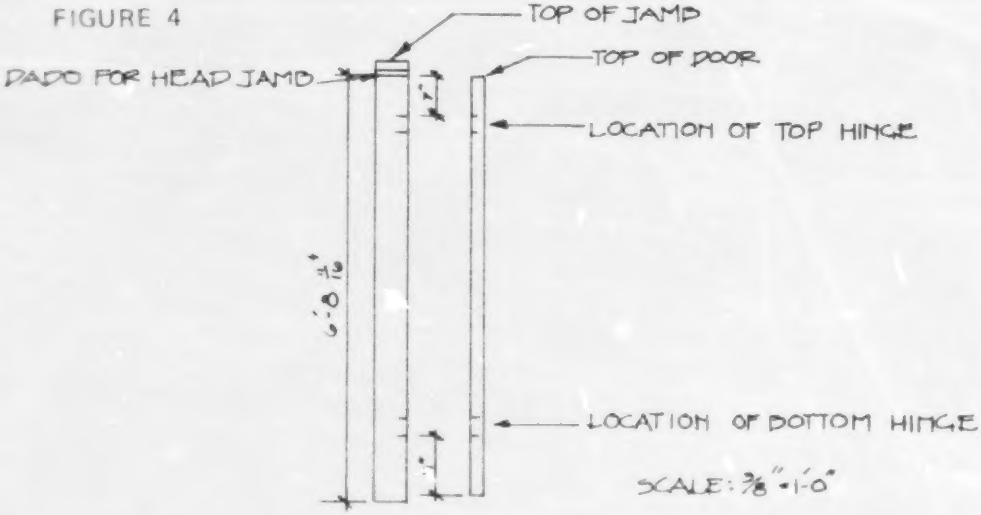

CLEARANCE BETWEEN JAMB AND HEADER
HINGE SIDE OF DOOR
BLOCKING AT LATCH LEVEL
BLOCKING FOR BUTTS
SCALE: 3/8"=1'-0"

DOOR JAMB IN POSITION WITH BLOCKING

C. Hang door to jamb

1. Use butt gauge to mark upper and lower hinge locations on jamb (Figure 4)

FIGURE 4


TOP OF JAMB
TOP OF DOOR
DADO FOR HEAD JAMB
7"
LOCATION OF TOP HINGE
6'-8 1/2"
LOCATION OF BOTTOM HINGE
SCALE: 3/8"=1'-0"

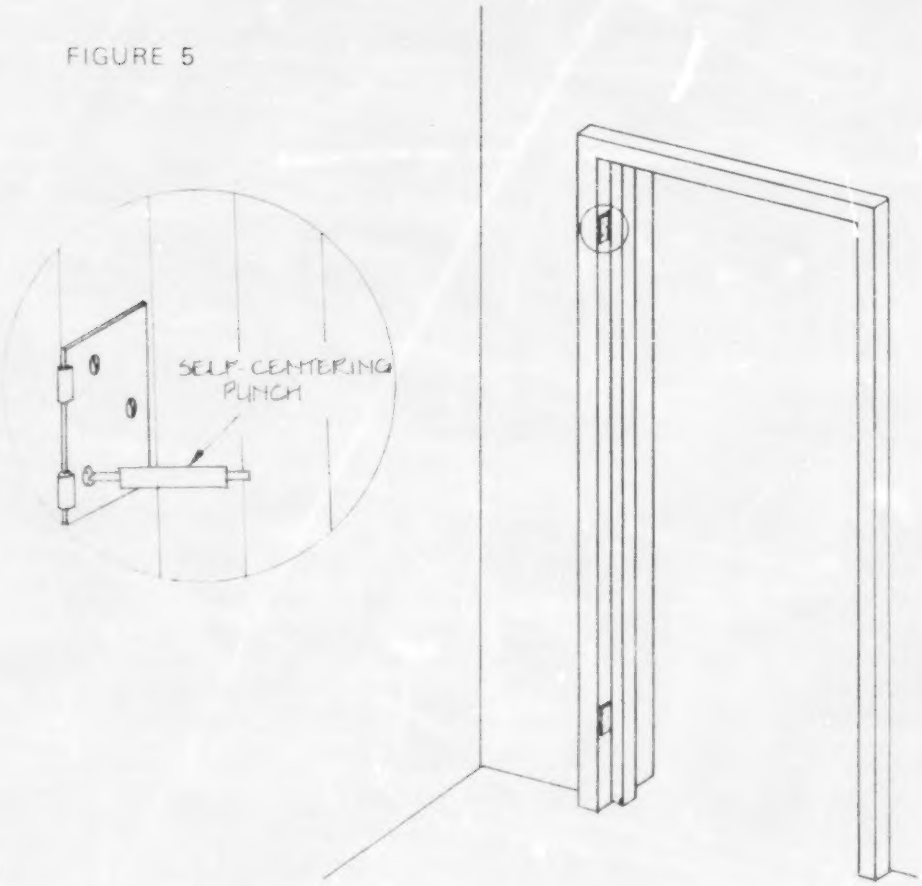
JOB SHEET #1

2. Use 1 1/2" chisel to mortise out for hinges

   (NOTE: Hinges should be flush with surface of jamb when finished.)

3. Place hinge in mortise and use self-centering punch to set screw holes (Figure 5)

FIGURE 5



4. Install hinges

5. Set door in opening, spacing door 1/16" from header

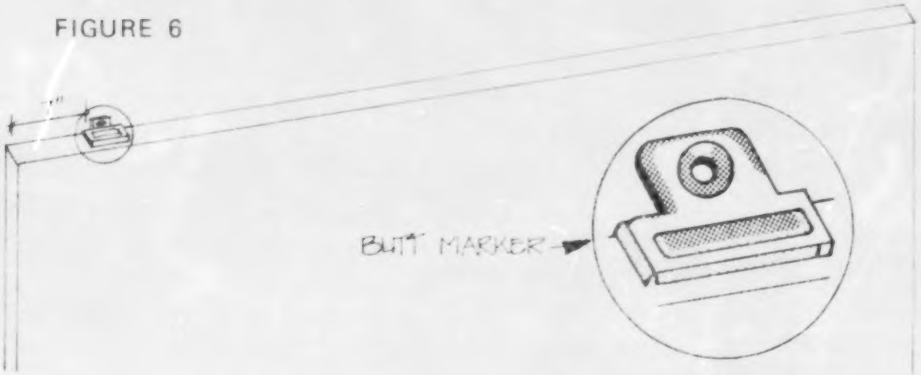
   (NOTE: A nickle or a 4d finish nail may be used as a spacer.)

6. Mark top of hinge on door using a utility knife

JOB SHEET #1

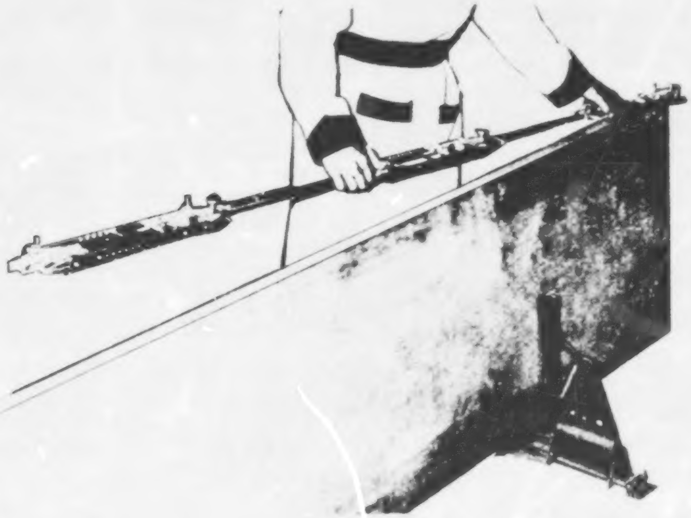
7. Set door in door jack and mark hinge location with butt marker (Figure 6)

FIGURE 6



8. Set routing template in position on door (Figure 7)

FIGURE 7



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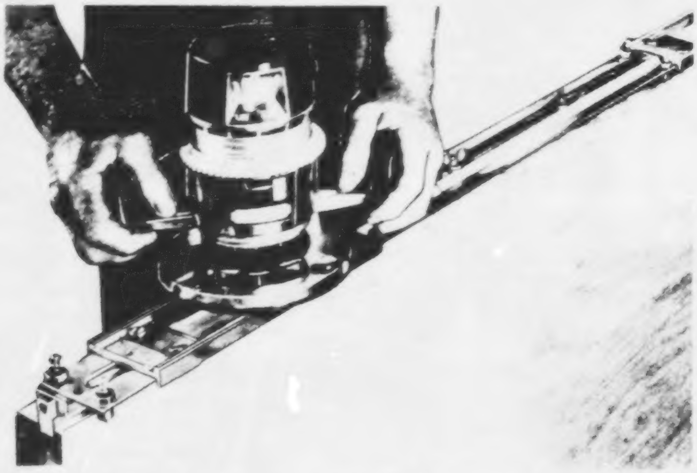
JOB SHEET #1

9. Use router to cut out for hinges (Figure 8)

   (NOTE: If square cornered hinges are used, it will be necessary to use chisel to mortise out corners.)

FIGURE 8



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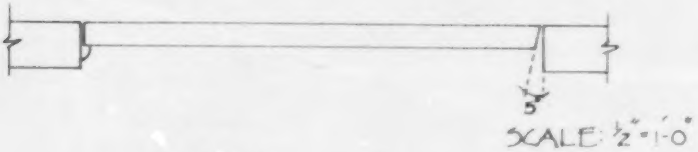
10. Place hinge in mortise and use self-centering punch to set screw holes

11. Install hinges

    (NOTE: If there is a hinge bind, it may be necessary to shim behind hinge to adjust door.)

12. Turn door over and, using plane, cut a 5° bevel on door edge in direction of the closing (Figure 9)

    FIGURE 9



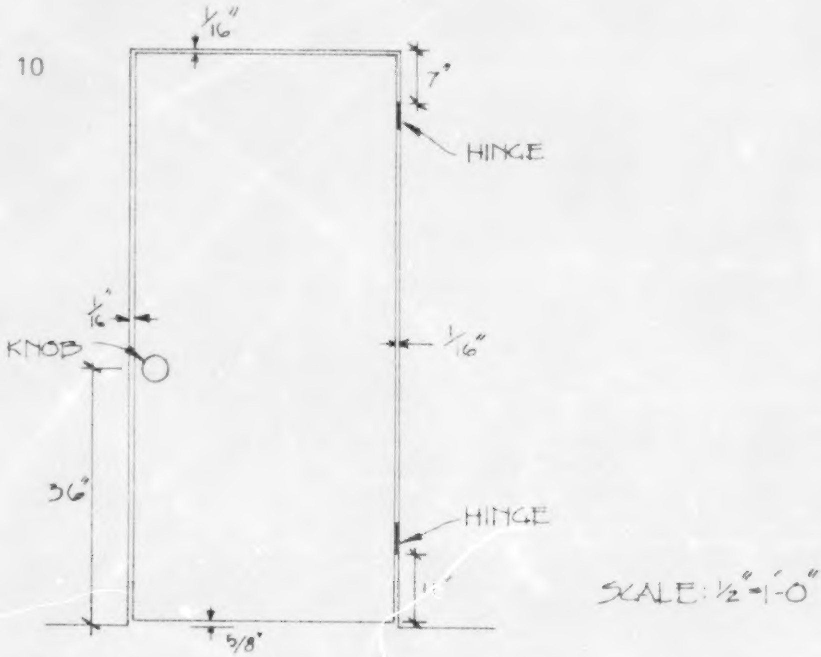
(NOTE: Some contractors prefer to bevel both door edges which eliminates any chance of a hinge bind.)

13. Set door in opening and attach hinges

JOB SHEET #1

14. Check fit and clearance (Figure 10)

FIGURE 10



D. Fit jamb to door

1. Use shims and 8d finish nails to fit lock side of jamb to door

2. Check header for proper fit and clearance

3. Place shims behind striker location and shim and nail as needed for rigidity and straightness

   (NOTE: Striker location is usually 36" from floor.)

4. Use handsaw to cut off all shingles that protrude past finish wall

   (CAUTION: Do not break off shingles; this may damage alignment of jamb.)

5. Use proper nail set to set all nails

E. Lock and stop door

1. Place mark on door 36" up from floor

2. Attach lock jig to door

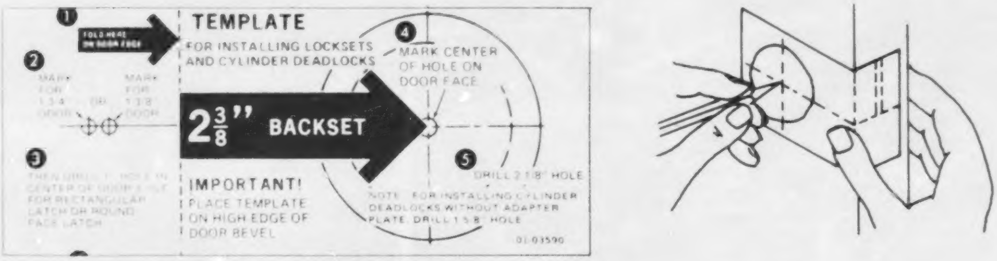
   (NOTE: Drill cylinder hole first and plunger hole next.)

JOB SHEET #1

3. Use template from lock manufacturer to mark door (Figure 11)

   (NOTE: Proper hole sizes and setbacks are given on these templates.)

FIGURE 11


1
FOLD HERE ON DOOR EDGE
TEMPLATE
FOR INSTALLING LOCKSETS AND CYLINDER DEADLOCKS
2
MARK FOR 1 3/4" DOOR
OR
MARK FOR 1 3/8" DOOR
$2\frac{3}{8}$" BACKSET
4
MARK CENTER OF HOLE ON DOOR FACE
3
THEN DRILL 1" HOLE IN CENTER OF DOOR EDGE FOR RECTANGULAR LATCH OR ROUND FACE LATCH
IMPORTANT!
PLACE TEMPLATE ON HIGH EDGE OF DOOR BEVEL
5
DRILL 2 1/8" HOLE
NOTE: FOR INSTALLING CYLINDER DEADLOCKS WITHOUT ADAPTER PLATE, DRILL 1 5/8" HOLE
01-03590

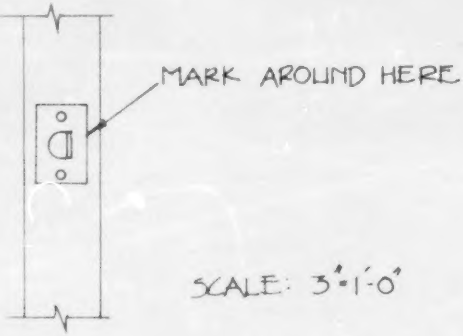
4. Use brace and bit to drill cylinder hole

   (NOTE: Drill until drill point shows through on opposite side; then drill from that side.)

5. Drill plunger hole

6. Place plunger in hole and mark around flange (Figure 12)

FIGURE 12


MARK AROUND HERE
SCALE: 3"=1'-0"

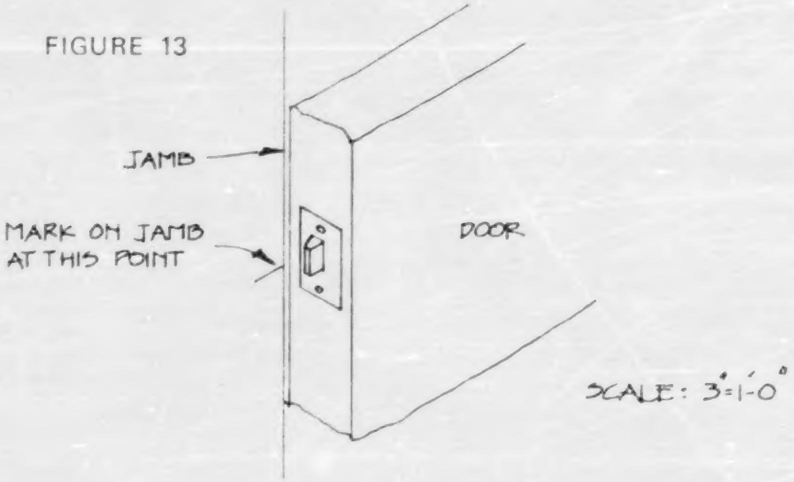
7. Mortise out so plate sets flush with door edge

8. Install plunger

   (NOTE: At this time it is not recommended to install entire lock.)

9. Locate top of striker plate by closing door and marking on jamb the location of the striker (Figure 13)

FIGURE 13



10. Locate depth of striker plate

    (NOTE: This is done by measuring on the door the distance from plunger to the edge of door and then transferring this measurement to the jamb.)

11. Use 1" bit to drill a hole in center of striker mark

    (CAUTION: Do not drill all the way through jamb.)

12. Mortise out remainder of striker plate so that plate will fit flush with jamb

13. Insert plate in mortise and, using self-centering punch set, screw holes

14. Install striker plate

F. Install door stop

1. Cut door stop header to length

   (NOTE: Miter both ends of stops.)

2. Nail stop in place with door closed

3. Cut door stop legs to length

   (NOTE: Side stops are cut about 1" shorter than distance from head jamb to floor.)

JOB SHEET #1

4. Use 4d finish nails to nail side stops to jamb with about 1/16" clearance between stop and door

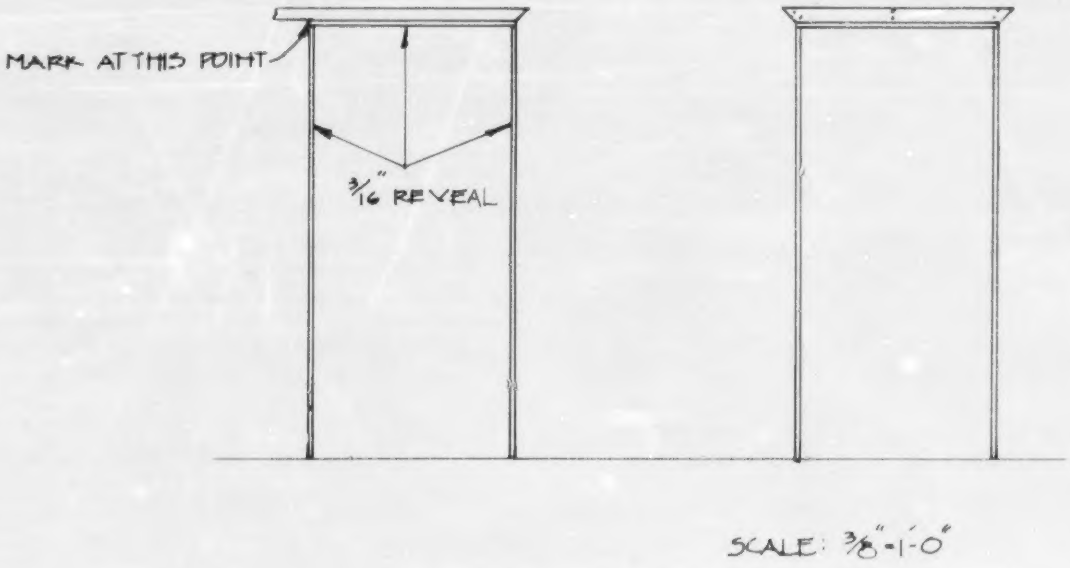
   (NOTE: Space nails approximately 12" apart.)

G. Case the door

1. Rough cut casing sides with a 45° miter on one end and place by doors
2. Rough cut headers with a 45° miter on one end and place by doors
3. Hold header casing up to door jamb with mitered end flush with reveal mark and mark opposite end (Figure 14)

   (NOTE: Reveal should be 3/16".)

FIGURE 14

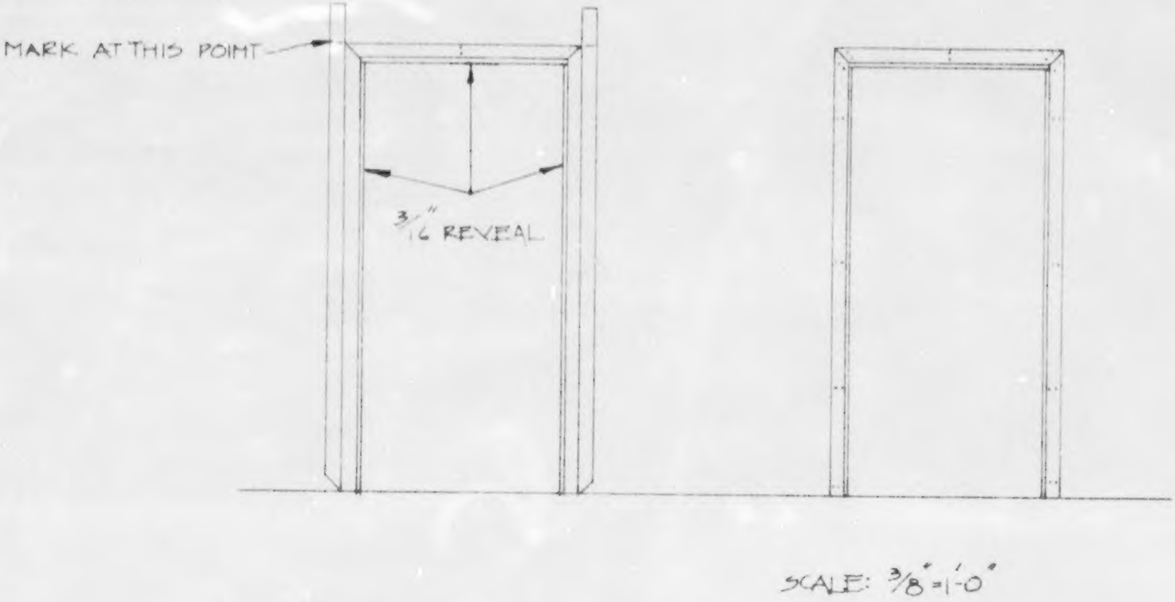


4. Cut header casing on mark and nail in place using 3d or 4d finish nails in jamb and 6d finish nails in wall

JOB SHEET #1

5. Turn casing sides upside down, hold against door jamb, and mark (Figure 15)

FIGURE 15


MARK AT THIS POINT
3/16" REVEAL
SCALE: 3/8"=1'-0"

6. Cut sides to length; nail and glue in place

   (NOTE: Use glue on miters and be sure casings have a perfect fit without gaps in the mitered corners.)

DOOR HANGING AND TRIM
UNIT II

JOB SHEET #2--CASE A WINDOW

I. Tools and materials

  A. Tools

    1. Radial arm or table saw with finishing blade
    2. Miter saw
    3. Crosscut handsaw
    4. Claw hammer
    5. Tri-square
    6. Tape measure, 12 or 16 foot
    7. Jointer
    8. Nail set, 1/16"

  B. Materials

    1. Lumber to make the window frame
      a. Header
      b. Sides
      c. Stool
    2. Casing for window frame and apron
    3. Nails
      a. 8d finish for frame
      b. 6d finish for casing
      c. 4d finish for casing
    4. Glue

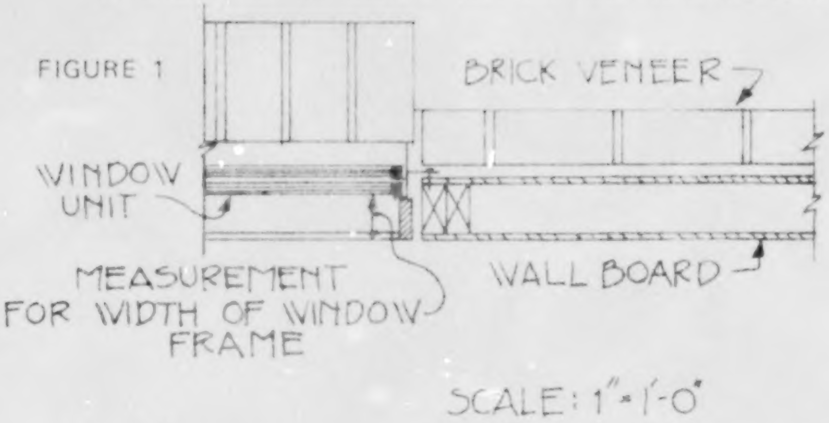
JOB SHEET #2

II. Procedure for trimming to an aluminum window unit

A. Install window frame

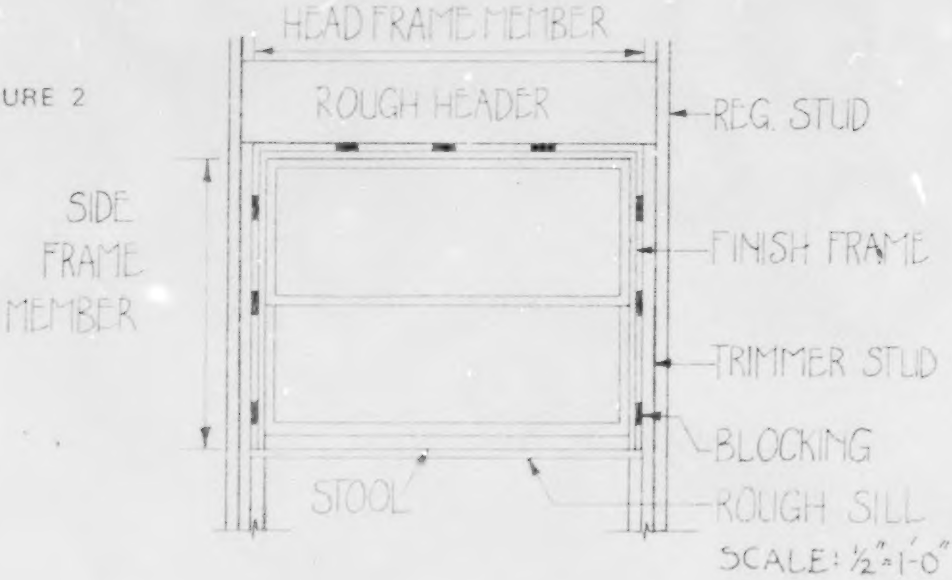
1. Measure for the width of side and head frame members (Figure 1)

FIGURE 1


BRICK VENEER
WINDOW UNIT
MEASUREMENT FOR WIDTH OF WINDOW FRAME
WALL BOARD
SCALE: 1"=1'-0"

2. Measure the length of head and side frame members (Figure 2)

FIGURE 2


HEAD FRAME MEMBER
ROUGH HEADER
REG. STUD
SIDE FRAME MEMBER
FINISH FRAME
TRIMMER STUD
BLOCKING
STOOL
ROUGH SILL
SCALE: ½"=1'-0"

(NOTE: The head frame member is measured to fit between the trimmer studs. The side members are measured from the bottom of the head frame member to the top of the rough sill.)

3. Cut frame members to size

(NOTE: Allow enough material in the width to joint both edges.)

JOB SHEET #2

4. Install frame

   a. Install head frame member first with the lower edge of the head frame on the trim line of the window unit; block and nail in place with 8d finish nails

   b. Install side frames with the inside edges being on the side trim lines of the window unit and the top butted firmly against the head frame member; block and nail in place with 8d finish nails

5. Install sill

   a. Lay out and cut sill to size and shape (Figure 3)

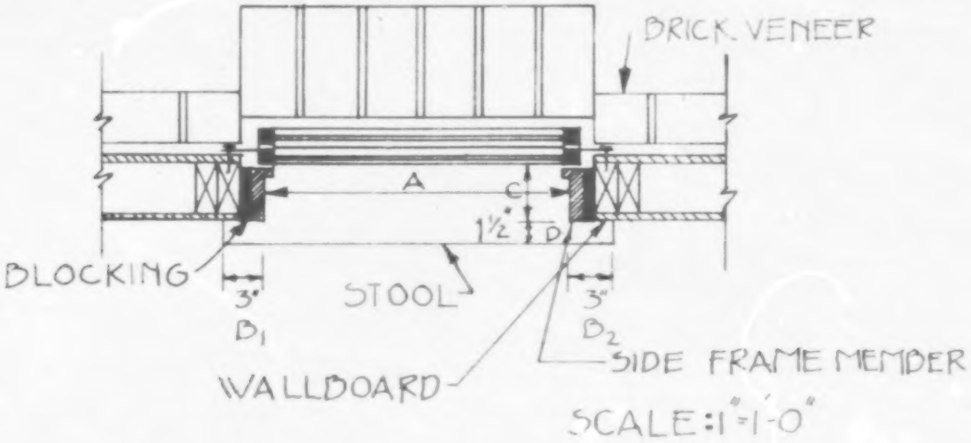
      1) Measure the distance between the side jambs (dimension A)

      2) Add dimensions B_1 and B_2 to dimension A for the rough length of the sill

      3) Measure the distance from the window unit to the room side edge of the side frame member for dimension C

      4) Add dimension D for the rough width of the stool

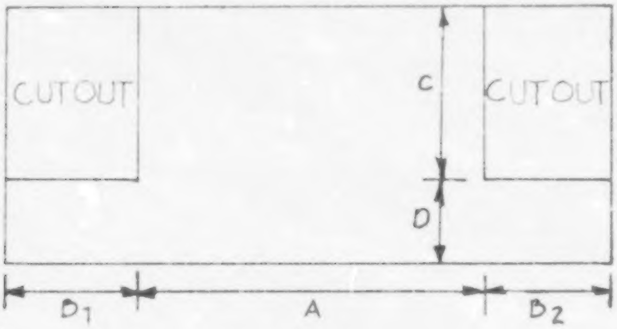
FIGURE 3


BRICK VENEER
A
C
1½"
D
BLOCKING
3"
B_1
STOOL
3"
B_2
SIDE FRAME MEMBER
WALLBOARD
SCALE: 1" = 1'-0"

JOB SHEET #2

5) Lay out the stool and cut out (Figure 4)

FIGURE 4


CUTOUT
C
CUTOUT
D
D1
A
D2

b. Install the sill with blocking between the sill and the rough sill to bring the top face of the sill up to the trim line on the bottom of the window unit; wedge between the sides and nail in place with 8d finish nails

(NOTE: The sill must fit the window unit, the frame sides, and the face of the wall.)

B. Case window

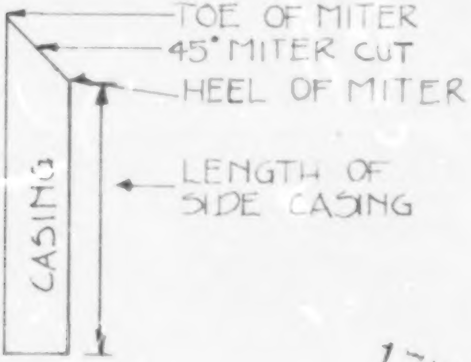
1. Cut casing for sides (Figure 5)

a. Measure from top of stool to bottom face of head frame

b. Add 3/16" for the setback on the frame

(NOTE: This is the measurement for the heel cut of the forty-five degree miter.)

FIGURE 5


TOE OF MITER
45° MITER CUT
HEEL OF MITER
LENGTH OF SIDE CASING
CASING

1791

JOB SHEET #2

c. Cut two sides for each window

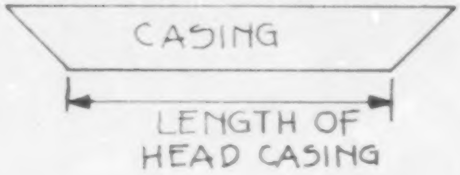
2. Cut head casing (Figure 6)

   a. Measure the opening between the side frames

   b. Add 3/8" for the setback on both side frames

   (NOTE: This is the measurement for the heel cut of the forty-five degree miter.)

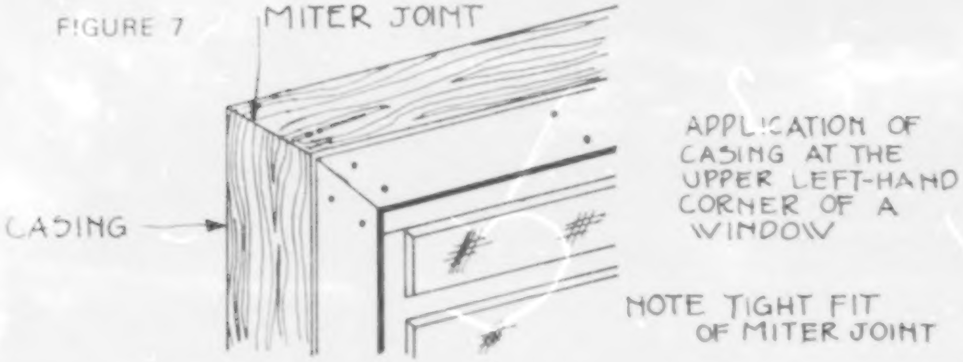
FIGURE 6


CASING
LENGTH OF HEAD CASING

3. Install casing (Figure 7)

(NOTE: The miter joints should be glued and must fit tightly all the way across.)

FIGURE 7

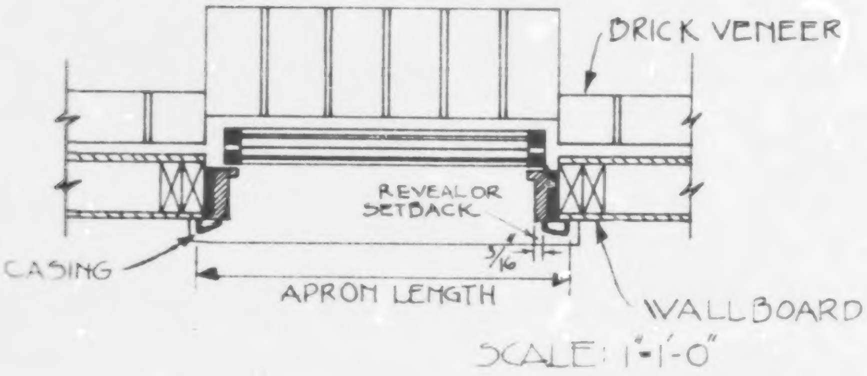

MITER JOINT
CASING
APPLICATION OF CASING AT THE UPPER LEFT-HAND CORNER OF A WINDOW
NOTE TIGHT FIT OF MITER JOINT

JOB SHEET #2

4. Cut and install apron

   a. Measure the length of the apron from the outside of the casing on the left side of the window to the outside of the right casing (Figure 8)

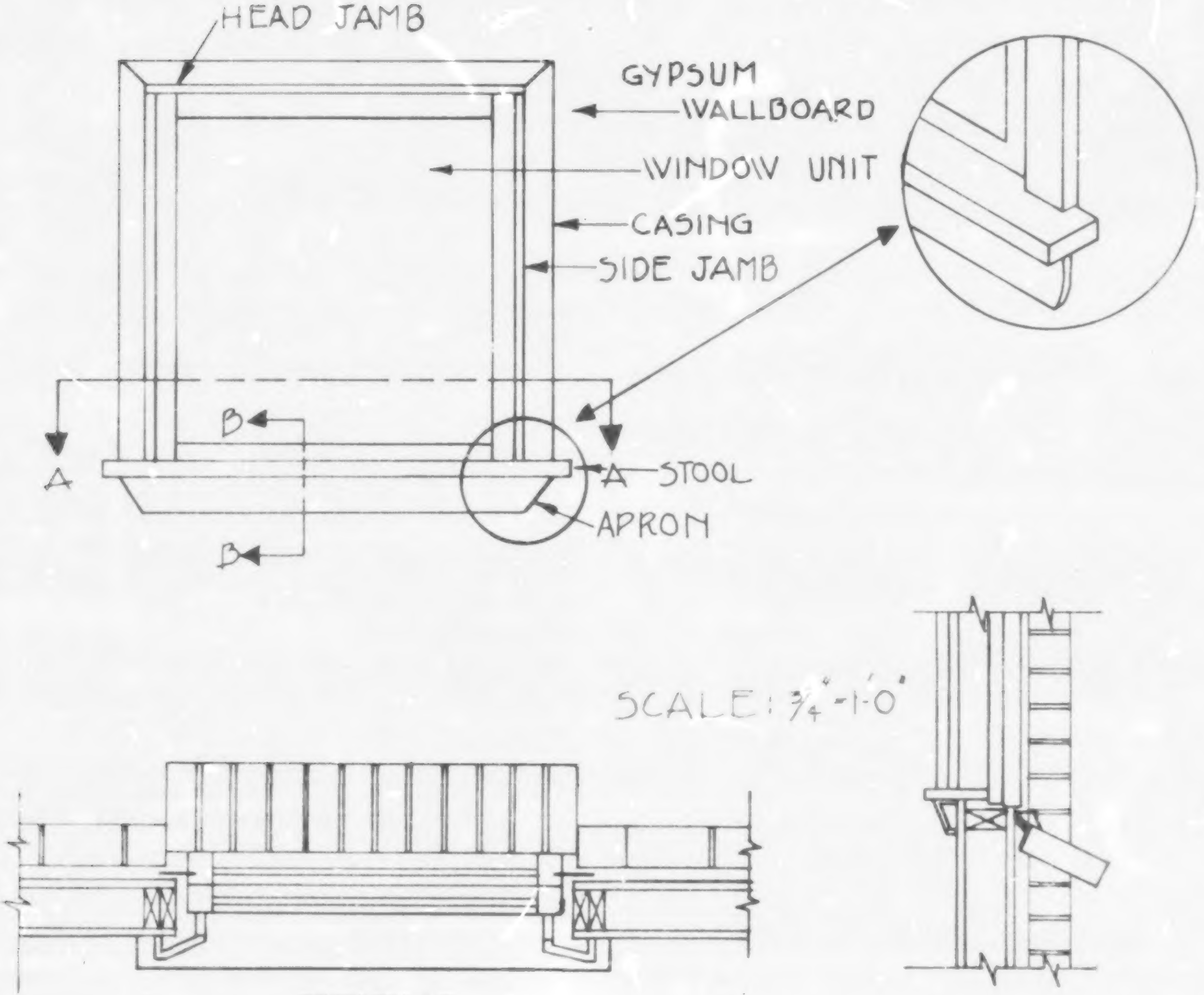
FIGURE 8


BRICK VENEER
REVEAL OR SETBACK
5/16
CASING
APRON LENGTH
WALLBOARD
SCALE: 1"=1'-0"

JOB SHEET #2

b. Cut the apron to length, shape the ends, and nail in place directly under the stool with 6d finish nails (Figure 9)

FIGURE 9


HEAD JAMB
GYPSUM WALLBOARD
WINDOW UNIT
CASING
SIDE JAMB
STOOL
APRON
A
A
B
B
SCALE: 3/4" = 1'-0"

SECTION AA

SECTION BB

DOOR HANGING AND TRIM
UNIT II

JOB SHEET #3--CASE A DOOR FRAME

I. Tools and materials

  A. Tools

    1. Miter saw
    2. Tape measure, 12 or 16 foot
    3. Claw hammer, 13 ounce
    4. Nail set, 1/16"

  B. Materials

    1. Casing material
    2. Nails
      a. 6d finish
      b. 4d finish
    3. Glue

II. Procedure

  A. Measure and cut side casing to length

    1. Measure from the floor to the face of the head jamb
    2. Add 3/16" for setback

       (NOTE: This is the measurement to the heel of the miter.)

    3. Cut a pair of sides for each side of the door

       (NOTE: A pair of sides includes a left-hand and right-hand cut.)

  B. Measure and cut head casing to length

    1. Measure between the two side jambs
    2. Add 3/8" for setback on both sides

       (NOTE: This is the length of the header from the heel of the miter at one end to the heel of the miter at the other end.)

    3. Cut one for each side of the door

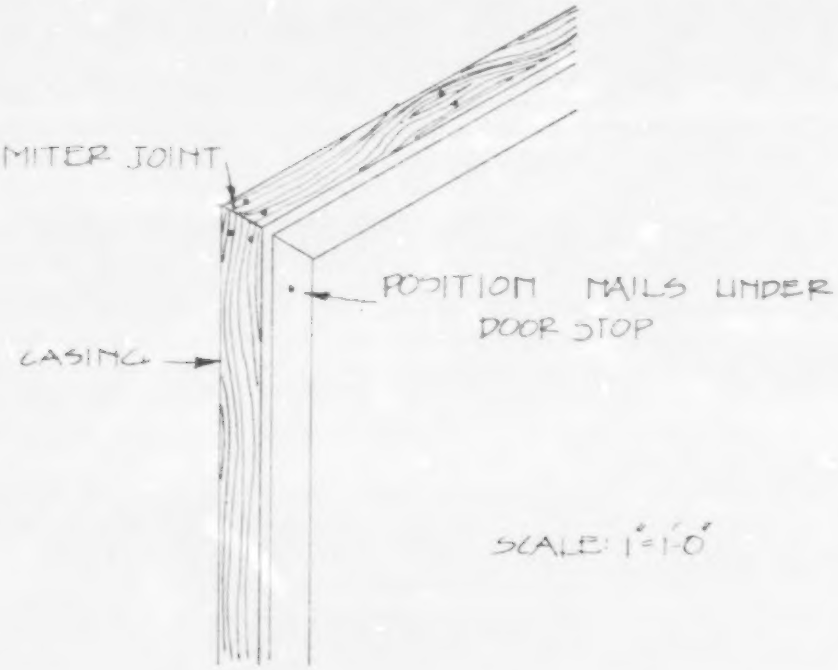
JOB SHEET #3

C. Install casing

1. Nail the head casing in place with the 3/16" setback at all points
2. Apply glue to the miter joint and nail the side casing to the door frame (Figure 1)

   (NOTE: Nail only at the corner, making sure that the miter joint fits tightly at all points. Allow the glue to dry for several hours before nailing the rest of the side casing in place.)

FIGURE 1


MITER JOINT
POSITION NAILS UNDER DOOR STOP
CASING
SCALE: 1"=1'-0"

DOOR HANGING AND TRIM
UNIT II

JOB SHEET #4--INSTALL A PREHUNG DOOR UNIT

I. Tools and materials

A. Tools

1. Hammer, 13 oz
2. Level, hand
3. Handsaw, 12 point
4. Nail set
5. Sawhorses, one pair

B. Materials

1. Prehung door units
2. Nails
3. Shim shingles

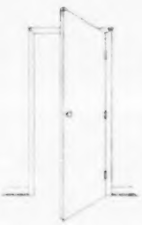
II. Procedure

A. Check hand and size of door (Figure 1)

(CAUTION: The right-hand door in Figure 1 would require a left-hand reverse lock. The left-hand door would require a right-hand reverse lock if the door opens toward you when standing on the security side.)

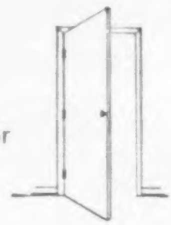
FIGURE 1

Important: Be Sure to Specify Left Hand or Right Hand



Left Hand Door

1. Face the door on the hinge side
2. Knob on the left--Left-hand door
3. Knob on the right--Right-hand door



Right-Hand Door

Rough Opening

Width--Door Size + 2"

Height--Door Height + 2" from Finished Floor

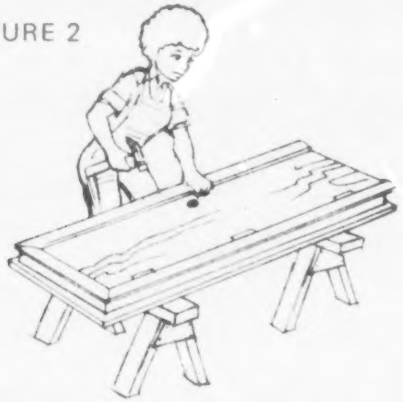
JOB SHEET #4

B. Uncrate door

C. Lay unit on sawhorses with hinges up

D. Remove small nails driven through the jamb into the door on the lock side (Figure 2)

FIGURE 2

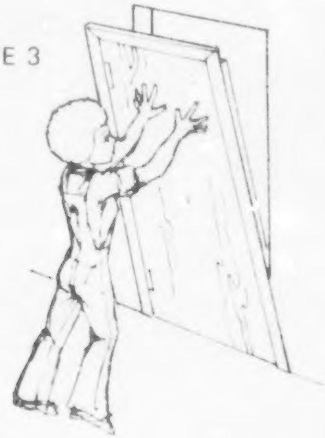


E. Separate the two halves by lifting the top half

F. Set this portion in the rough opening (Figure 3)

(NOTE: There are three spacer blocks between the door and the side jamb and three spacer blocks between the door and the head jamb on the back side.)

FIGURE 3



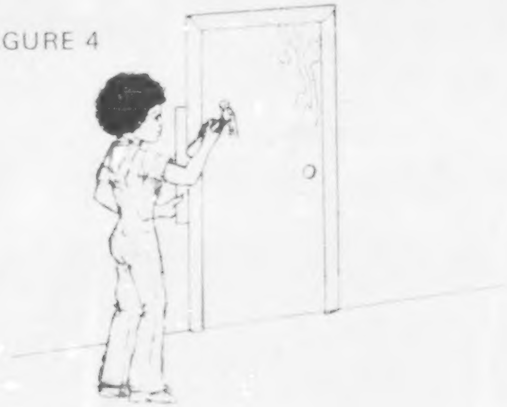
G. Check jambs and make certain the jambs are against all spacer blocks and that both jambs are on the floor

JOB SHEET #4

H. Check trim for plumb (Figure 4)

(NOTE: When trim is plumb the upper spacer block should be against the head jamb.)

FIGURE 4

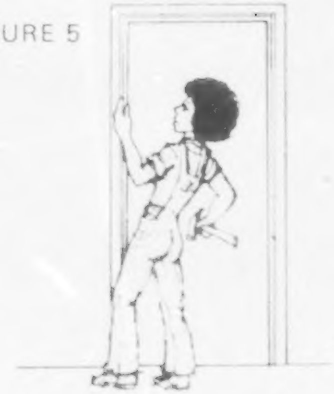


I. Nail trim to wall

(NOTE: On lock side of door, push the jamb tightly against the spacer blocks to maintain uniform clearance between the door and jamb before nailing trim.)

J. Move through opening to opposite side of the door (Figure 5)

FIGURE 5



K. Shim between jamb and stud

(NOTE: Close door with spacers still attached. Place shims at each hinge and at the top and bottom. Lock on the opposite jamb.)

L. Nail through jamb and shims into stud

(CAUTION: Do not nail through stop.)

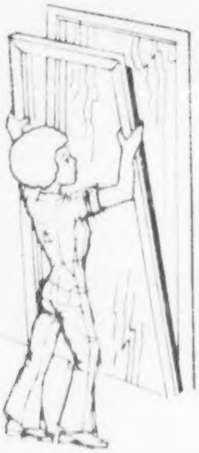
(NOTE: Spacer block can be removed after this step is completed.)

JOB SHEET #4

M. Insert remaining half of jamb and trim into grooved section containing the door (Figure 6)

(NOTE: This half will automatically be plumb.)

FIGURE 6

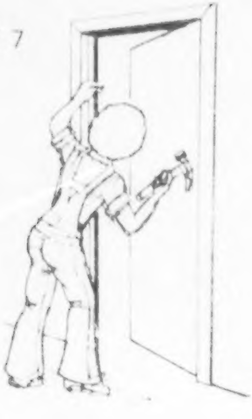


N. Nail trim to wall

O. Nail jamb to studs (Figure 7)

(NOTE: Nail through stop.)

FIGURE 7



P. Install the lock

(NOTE: The door is predrilled for lock.)

Q. Check operation of the door

(NOTE: When knob is released after retracting bolt, the bolt should snap out to its fully extended position. If it does not, loosen knob screws and reposition. Also, check face of bolt for plumb.)

DOOR HANGING AND TRIM
UNIT II

TEST

NAME ________________________ SCORE ____________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Assembly of wood parts that form an enclosure and support for a door

______b. Notch or mortise cut to receive a hinge or other hardware

______c. Top member of a door frame

______d. Contrivance used for guiding tools while work is being done

______e. Ends of any two pieces of board of corresponding shape cut off at an angle and fitted together in an angular shape

______f. Type of molding which presents a profile of a quarter of a circle

______g. Vertical side posts of a door frame

______h. Base or support at the bottom of a window that extends into the room

______i. Gauge which is used as a guide for forming or shaping

______j. Wood or metal member used to close the space at the bottom of a door at the sill

______k. Visible finishing work in a building

______l. Piece of trim placed horizontally under the stool

______m. Finishing board covering the edge of the wallboard where the wall and floor meet

______n. Small narrow molding used around a room at the base of the baseboard

1. Jig
2. Trim
3. Template
4. Side jamb
5. Door frame
6. Head jamb
7. Miter joint
8. Gain
9. Stool
10. Threshold
11. Quarter round
12. Apron
13. Baseboard
14. Base shoe

______o. Type of door hinge where one leaf is mortised into the edge of the door and the other leaf is mortised into the side jamb

______p. Framework of trim around a window or door

______q. Spacing between the edge of a door and the jamb

______r. To cut or shape the end of a piece of molding so it will cover and fit the contour of an adjoining piece of molding

______s. Molding with a concave profile used primarily for trim where the wall meets the ceiling

______t. That part of a jamb between edge of jamb and trim; usually 3/8"

15. Butt
16. Cope
17. Cove molding
18. Casing
19. Clearance
20. Reveal

2. Identify the parts of the interior door unit on the next page by writing the correct names in the blanks provided below.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

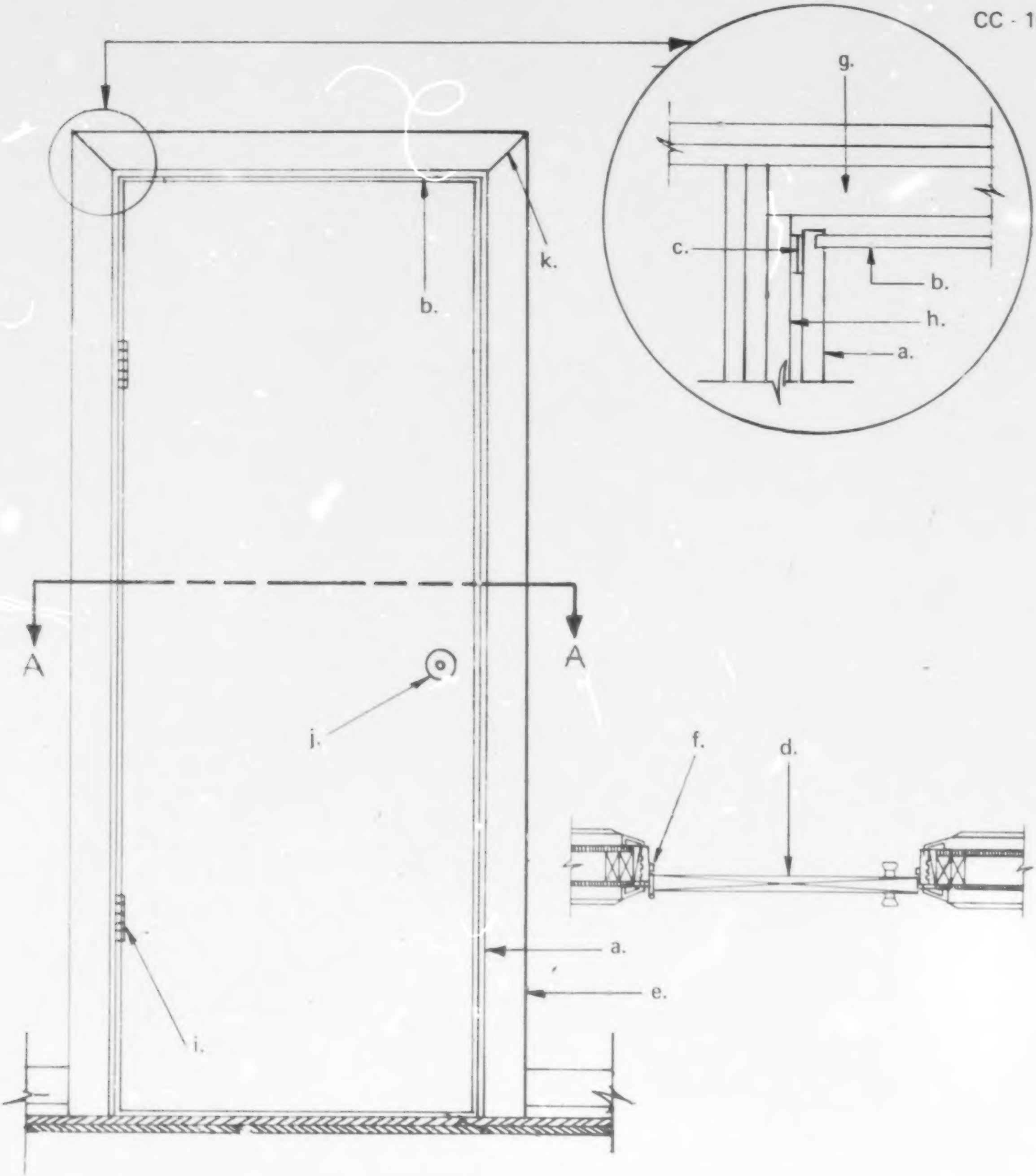
g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

k. ______________________________


g.
c.
b.
h.
a.
k.
b.
A
A
j.
f.
d.
a.
e.
i.

3. Name general types of interior door construction.

a. ______________________________

b. ______________________________

1803

4. Identify the hand of the doors illustrated below.

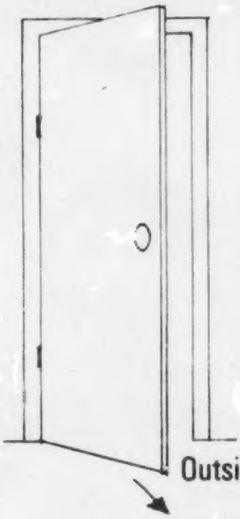
   a. ______________________________

   b. ______________________________

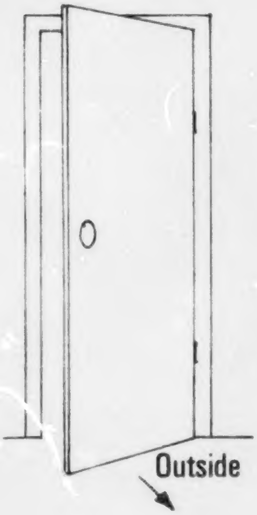
   c. ______________________________

   d. ______________________________

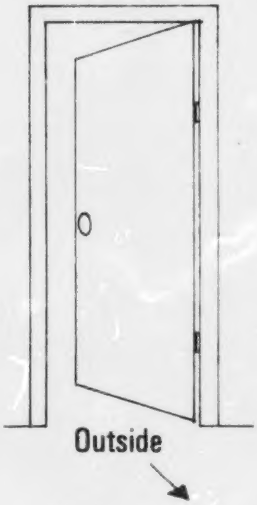
a.



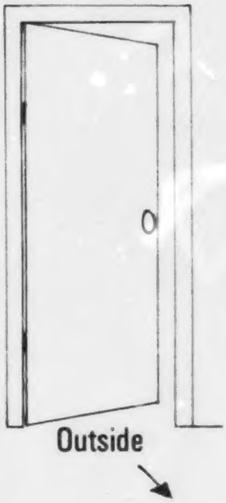
b.



c.



d.



5. State the standard dimensions for the following interior doors and frame components.

   a. Standard interior door sizes

      1) Thickness-- ______________________________

      2) Width-- ______________________________

      3) Height-- ______________________________

   b. Standard interior jamb sizes

      1) Width-- ______________________________

      2) Length-- ______________________________

      3) Thickness-- ______________________________

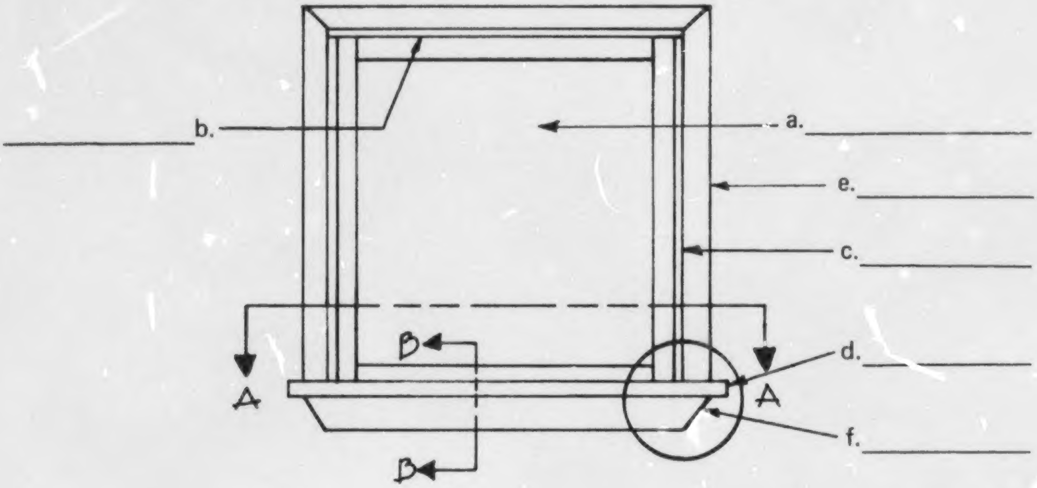
c. Casing--______________________________

____

d. Door stop--______________________________

____

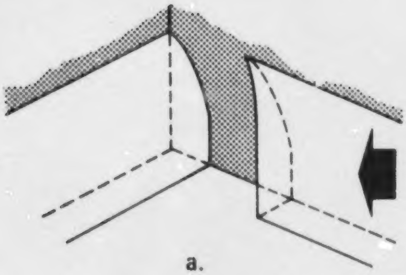
6. Identify the parts of a window installation from the illustration below.

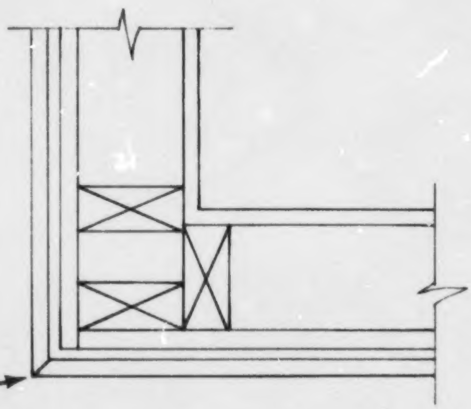


7. Identify the types of joints commonly used to install casing and trim.

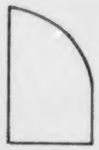
a. ______________________________

b. ______________________________

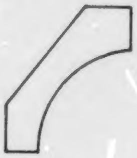

a.



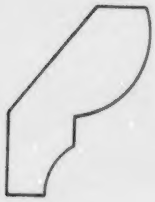
8. Identify types of molding.



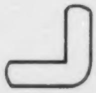
a. ____________________



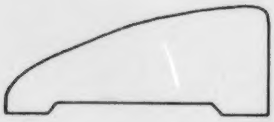
b. ____________________



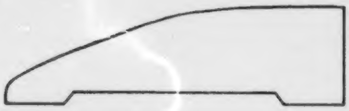
c. ____________________



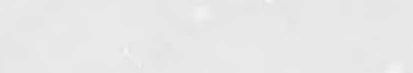
d. ____________________



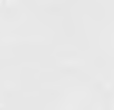
e. ____________________



f. ____________________

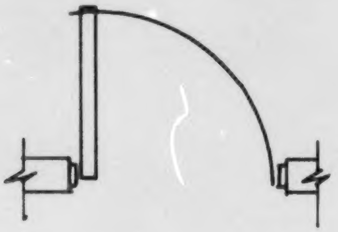


g. ____________________

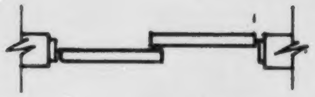


h. ____________________

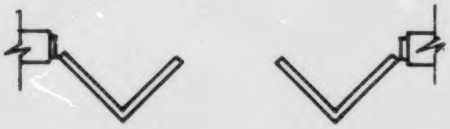
9. Identify the types of doors according to installation illustrated below.



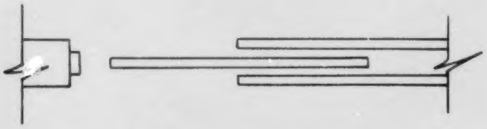
a. ______________________



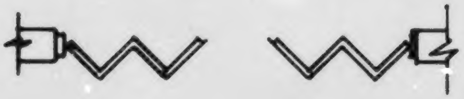
b. ______________________



c. ______________________



d. ______________________



e. ______________________

10. Estimate the following materials needed to trim the room pictured below.

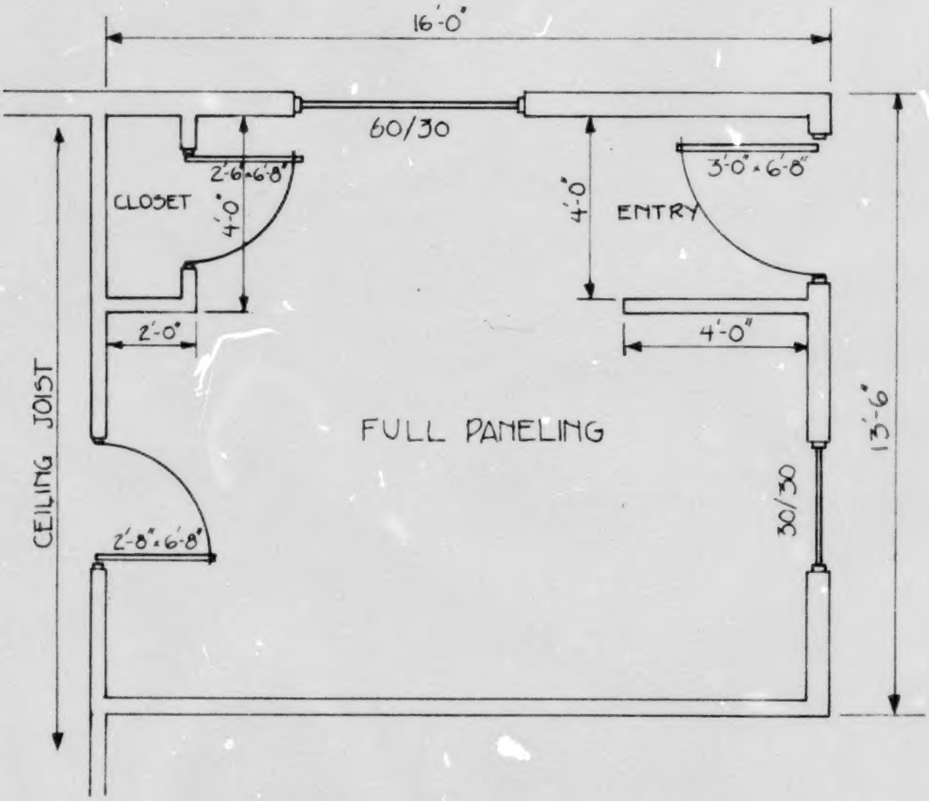
    a. Doors (interior)--____________________

    b. Jamb sets (interior)--____________________

    c. Casing--____________________

    d. Butts (interior)--____________________

    e. Baseboard--____________________


16'-0"
60/30
2'-6"×6'-8"
CLOSET
4'-0"
4'-0"
ENTRY
3'-0"×6'-8"
2'-0"
4'-0"
FULL PANELING
CEILING JOIST
30/30
13'-6"
2'-8"×6'-8"

11. Demonstrate the ability to:

    a. Install interior door frame, hang door, lock, and trim.

    b. Case a window.

    c. Case a door frame.

    d. Install a prehung door unit.

    (NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

DOOR HANGING AND TRIM
UNIT II

ANSWERS TO TEST

1. a. 5
b. 8
c. 6
d. 1
e. 7
f. 11
g. 4
h. 9
i. 3
j. 10
k. 2
l. 12
m. 13
n. 14
o. 15
p. 18
q. 19
r. 16
s. 17
t. 20

2. a. Side jambs
b. Head jamb
c. Blocking
d. Door
e. Casing
f. Door stop
g. Rough header
h. Trimmer stud
i. Butts
j. Lockset
k. 45° miter joint

3. a. Solid core
b. Hollow core

4. a. Left hand reverse
b. Right hand reverse
c. Right hand
d. Left hand

5. a. Standard interior door sizes
    1) 1 3/8"
    2) 2'-0", 2'-4", 2'-6", 2'-8", 3'-0"
    3) 6'-8"
   b. Standard interior jamb sizes
    1) 2'-0", 2'-4", 2'-6", 2'-8", 3'-0"
    2) 6'-8"
    3) 4 1/2"
   c. Casing--May be purchased precut to the jamb size or in random lengths of odd and even feet to be cut on the job
   d. Door stop--May be purchased precut to the jamb size or in random lengths of odd and even feet to be cut on the job

6. a. Window unit
   b. Head jamb
   c. Side jamb
   d. Stool
   e. Casing
   f. Apron

7. a. Coped joint
   b. Miter joint

8. a. Base shoe
   b. Cove
   c. Bed
   d. Corner
   e. Casing
   f. Baseboard
   g. Door and window stops
   h. Quarter round

9. a. Swinging
   b. Bypass
   c. Bifold
   d. Pocket
   e. Multifold

10. a. 1 - 2'-8" x 6'-8" and 1 - 2'-6" x 6'-8" interior doors
    b. 1 - 2'-6" x 6'-8" x 4 1/2" and 1 - 2'-8" x 6'-8" x 4 1/2" interior jamb sets
    c. 2 sets 2'-6" x 6'-8", 1 set 2'-8" x 6'-8", 1 set 3'-0" x 6'-8" casing; 2 pieces of 10' casing and 1 piece of 14' casing for windows
    d. 2 pair of 3 1/2" butts
    e. 76' baseboard

11. Performance skills evaluated to the satisfaction of the instructor

CABINET AND SHELF INSTALLATION
UNIT III

UNIT OBJECTIVE

After completion of this unit, the student should be able to identify the parts of a cabinet, the types of cabinet door installation, items of cabinet hardware, and joints used in cabinet construction. The student should be able to install a custom-built cabinet and install shelves in a closet. This knowledge will be evidenced by completion of the job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with cabinet and shelf installation to the correct definitions.
2. Identify the parts of a cabinet.
3. Identify types of cabinet door installation.
4. Identify items of cabinet hardware.
5. Identify joints used in cabinet construction.
6. Name types of cabinets.
7. Demonstrate the ability to:
    a. Install a custom-built cabinet.
    b. Install shelves in a closet.

CABINET AND SHELF INSTALLATION
UNIT III

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

  A. Provide students with objective sheet.

  B. Provide students with information and job sheets.

  C. Make transparencies.

  D. Discuss unit and specific objectives.

  E. Discuss information sheet.

  F. Demonstrate and discuss procedures outlined in job sheets.

  G. Give test.

II. Instructional materials:

  A. Objective sheet

  B. Information sheet

  C. Transparency masters

    1. TM 1--Parts of a Cabinet

    2. TM 2--Types of Cabinet Door Installation

    3. TM 3--Cabinet Hardware

    4. TM 4--Cabinet Joints

  D. Job sheets

    1. Job Sheet #1--Install a Custom-Built Cabinet

    2. Job Sheet #2--Install Shelves in a Closet

  E. Test

  F. Answers to test

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III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary*. Chicago, Illinois: American Technical Society, 1955.

B. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry*. 3rd ed. Chicago, Illinois: American Technical Society, 1963.

C. Smith, Ronald C. *Principles and Practices of Light Construction*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1970.

D. Wagner, Willis H. *Modern Carpentry*. Homewood, Illinois: Goodheart-Wilcox, 1969.

CABINET AND SHELF INSTALLATION
UNIT III

INFORMATION SHEET

I. Terms and definitions

   A. Fixtures--Display and storage units

   B. Counter unit--Base unit of a cabinet having a working surface

   C. Hardware--Those items in building construction that permit movement, are decorative, or are both; includes hinges, catches, pulls, and knobs

   D. Knob--Projection, usually round, for opening doors and drawers

   E. Plastic laminate--Hard, laminated plastic material used as a covering for counter tops

   F. Pull--Projecting device in the form of a handle for opening doors and drawers

   G. Rail--Horizontal bar of wood used to separate drawers and doors on the face of a cabinet

   H. Stile--One of the vertical members used to separate doors and drawers on the face of a cabinet and to support the top

   I. Toe space--Recessed space at the floor line of a base cabinet or other built-in that permits one to stand close without striking the vertical surface with toes

   J. Wall cabinet--Upper portion of a cabinet that is wall hung above the base cabinet

   K. Soffit--Underside of any subordinate member of a structure, such as the undersurface of an arch, cornice, or stairway

   L. Back splash--Vertical continuation of a counter top at the back and ends

   M. Shelves--Pieces of wood or other material fastened horizontally to a wall to hold objects

   N. Scriber--Tool with a sharp point and a pencil point used to make marks

II. Parts of a cabinet (Transparency 1)

   A. Toe space

   B. Soffit

   C. End panel

INFORMATION SHEET

- D. Rail
- E. Stile
- F. Shelf support
- G. Shelf
- H. Drawer guide
- I. Drawer
- J. Door
- K. Hinge
- L. Pull
- M. Knob
- N. Counter top
- O. Back splash

III. Types of cabinet door installation (Transparency 2)

- A. Lipped
- B. Surface
- C. Flush

IV. Cabinet hardware (Transparency 3)

- A. Knob
- B. Pull
- C. Friction catch
- D. Magnetic catch
- E. Semi-concealed hinge for 3/8" lipped doors
- F. Semi-concealed hinge for flush doors
- G. Concealed hinge for flush doors
- H. Monorail drawer guide

INFORMATION SHEET

V. Joints used in cabinet construction (Transparency 4)

  A. Butt joint

  B. Dado joint

  C. Rabbet joint

  D. Miter joint

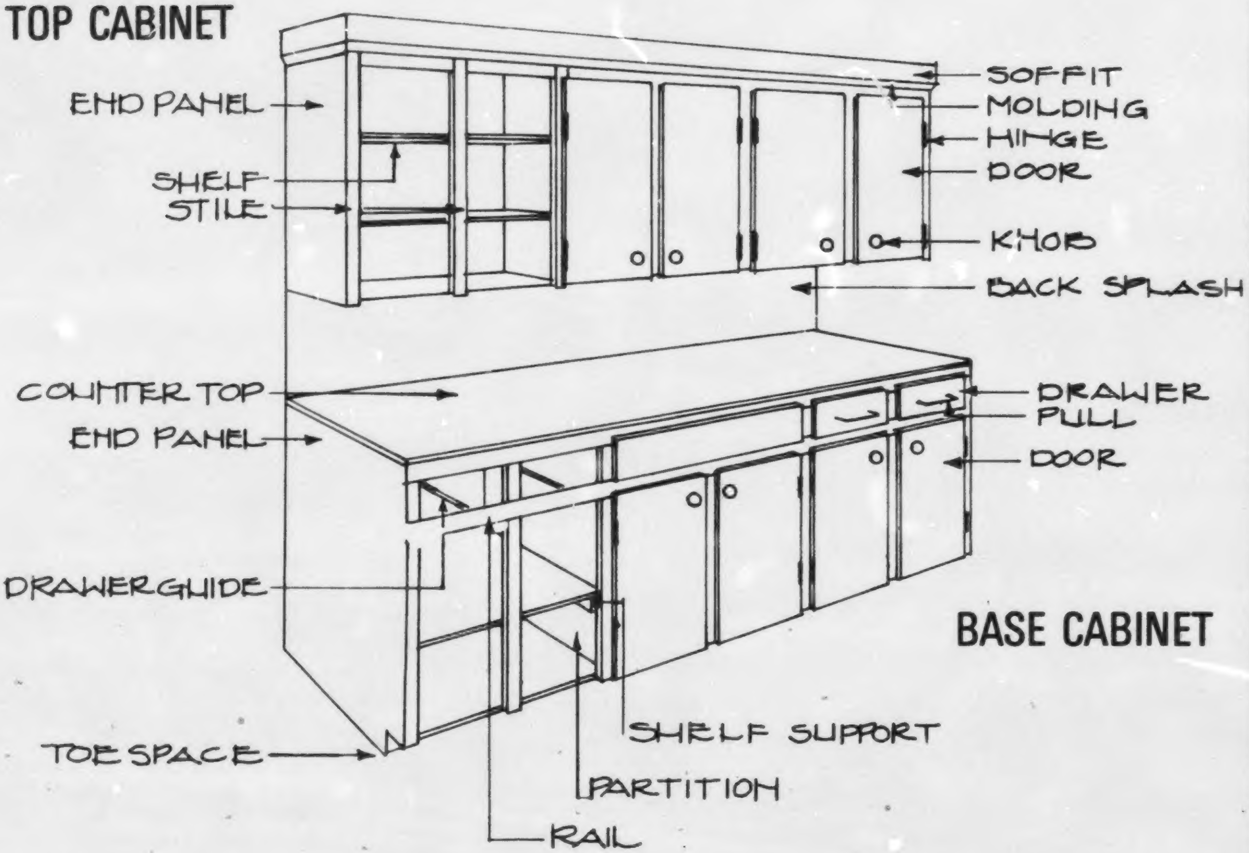
  E. Coped joint

VI. Types of cabinets

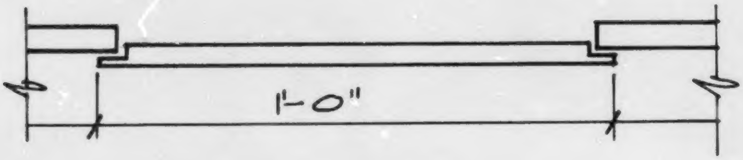
  A. Custom-built or mill-built

  B. Modular or stock units

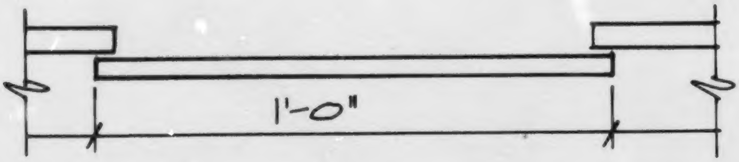
Parts of a Cabinet


TOP CABINET
END PANEL
SHELF
STILE
SOFFIT
MOLDING
HINGE
DOOR
KNOB
BACK SPLASH
COUNTER TOP
END PANEL
DRAWER
PULL
DOOR
DRAWERGUIDE
BASE CABINET
SHELF SUPPORT
TOE SPACE
PARTITION
RAIL

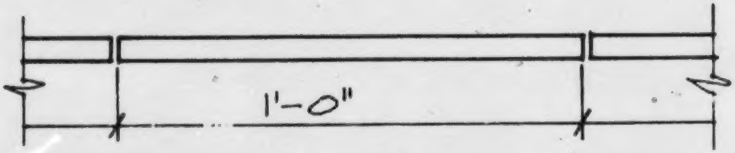
Types of Cabinet Door Installation



Lipped Door



Surface Door

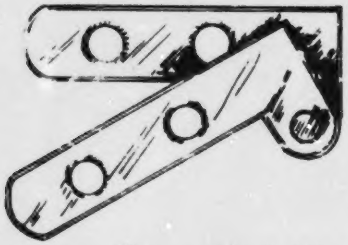


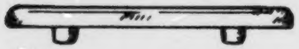
SCALE: 3" = 1'-0"

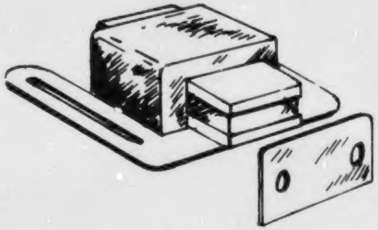
Flush Door

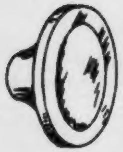
1819

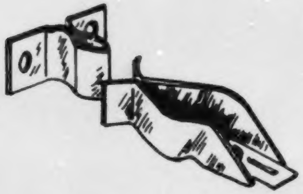
Cabinet Hardware

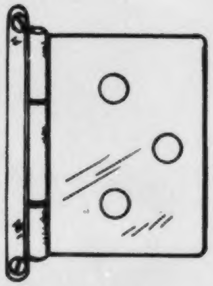

Concealed Hinge for Flush Doors

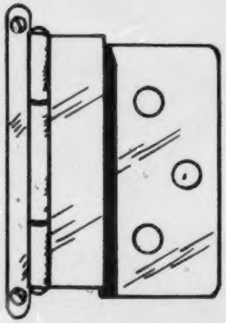

Pull

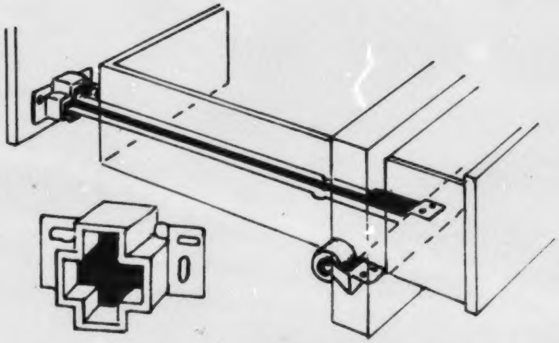

Magnetic Catch


Knob


Friction Catch


Semi-Concealed Hinge for Flush Doors


Semi-Concealed Hinge for 3/8" Lipped Doors


Monorail Drawer Guide

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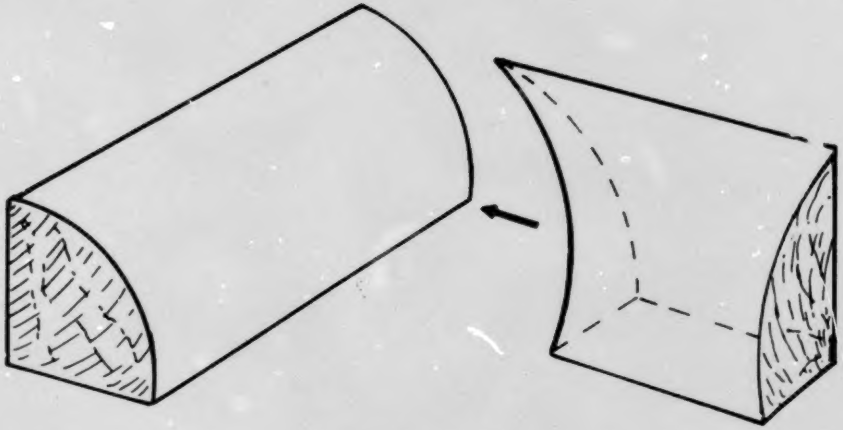
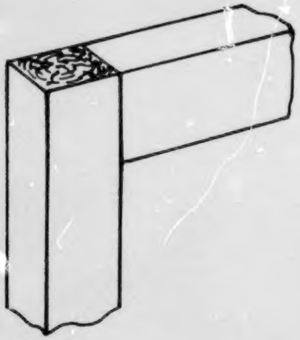
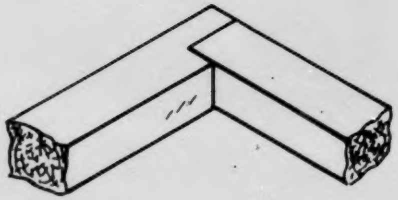
Cabinet Joints



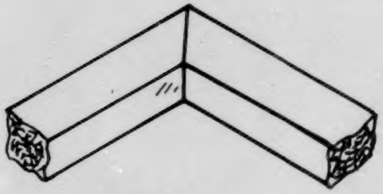
Coped Joint



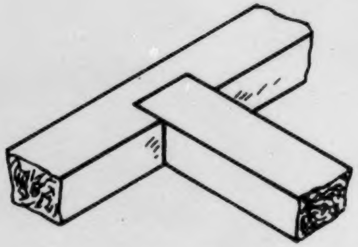
Butt Joint



Rabbet Joint



Miter Joint



Dado Joint

CABINET AND SHELF INSTALLATION
UNIT III

JOB SHEET #1--INSTALL A CUSTOM-BUILT CABINET

I. Tools and materials

A. Tools

1. Framing square
2. Level, hand
3. Claw hammer, 13 oz
4. Tape measure, 12 or 16 ft
5. Nail set
6. Scriber
7. Block plane
8. Handsaw, rip

B. Material

1. Cabinets, mill-built
2. 1 x 2's, 30' of scrap
3. Shim shingles
4. Sandpaper
5. Nails
    a. 6d finish
    b. 8d finish
6. Screws, no. 8 or 10, 2"

II. Procedure

A. Remove end stiles on lower cabinet

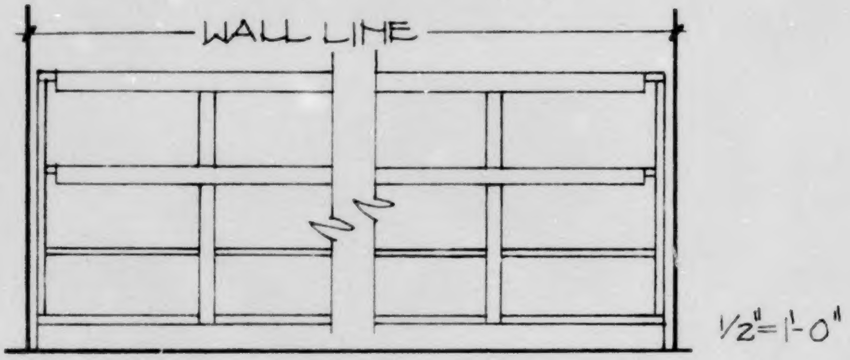
(NOTE: These are generally tacked on at the mill.)

JOB SHEET #1

B. Set bottom cabinet

1. Slide cabinet into location (Figure 1)

FIGURE 1



2. Level and plumb base cabinet

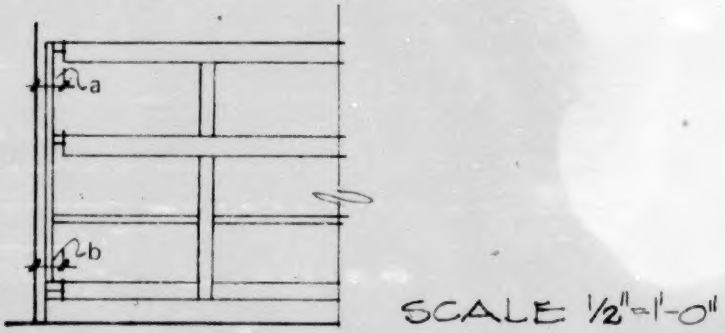
   (NOTE: Use shim shingles at wall and floor line.)

3. Equalize end clearance at both ends of the unit face
4. Nail cabinet to floor and wall

   (NOTE: If installation is on concrete slab, a nailing block should be secured to the slab back of the baseboard.)

5. Measure distances a and b (Figure 2)

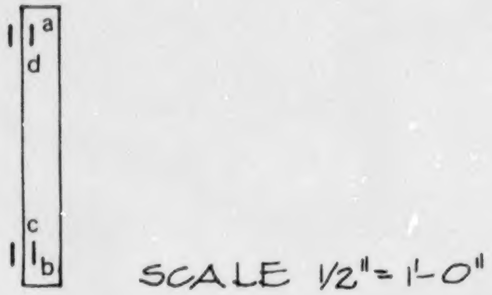
FIGURE 2



JOB SHEET #1

6. Transfer these distances to the loose stile (Figure 3)

FIGURE 3



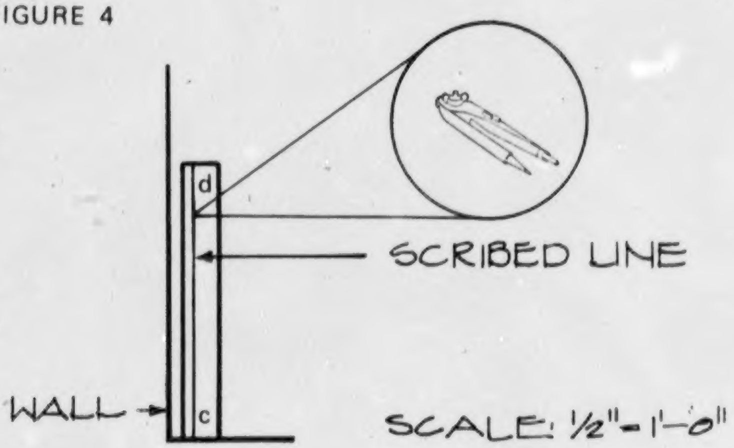
7. Tack stile to cabinet face with points c and d equal distance from the wall

8. Set scribers with the point end against the wall and adjust the pencil end to point d or c

9. Scribe line on length of stile (Figure 4)

   (NOTE: Hold scribers in the same relative position to wall and stile while scribing.)

FIGURE 4



10. Rip stile on scribed line

    (NOTE: Undercut the back side.)

JOB SHEET #1

11. Nail stile in place and set nails

    (NOTE: If stile is too tight in spots, plane high spots with block plane.)

12. Install other end stile following steps B-2 through B-11

C. Set upper cabinet

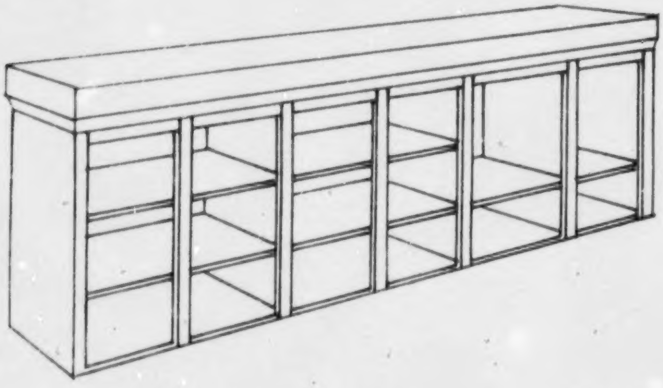
1. Remove loose end stiles

2. Cut spacers from 1 x 2 scrap to fit between upper and lower cabinet

   (NOTE: Allow for block on top of spacer so spacer will not dig into bottom of upper cabinet.)

3. Set upper cabinet in position and block up tight to soffit with spacers (Figure 5)

FIGURE 5



4. Check for level

   (NOTE: If cabinet is not level, shim between ceiling and rail to make it level.)

5. Scribe top rail to fit ceiling

6. Rip rail on scribed line

7. Reset cabinet tight to ceiling and secure to wall

   (NOTE: Fasten cabinet to wall with appropriate fasteners.)

8. Scribe end stiles as described in steps B-2 through B-11

JOB SHEET #1

D. Install counter top

1. Place lines on end walls to correspond to height of back splash

   (NOTE: Lines should be level.)

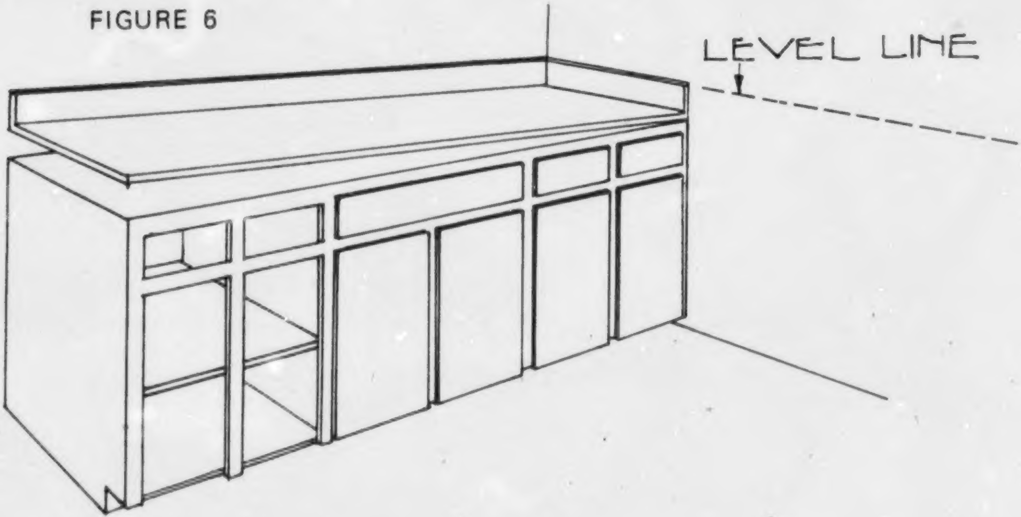
2. Measure the exact length of the opening front and back at the top of back splash lines

3. Check the length of the counter top front and back at the top of the back splash

4. Set counter in opening (Figure 6)

   (NOTE: Be sure counter is tight to back wall.)

FIGURE 6



5. Scribe top of back splash

6. Remove counter top and trim to scribe line

   (NOTE: If top is plastic laminate, use plane bit that has been ground and only sharpened on the rough stone to plane the laminate.)

7. Replace counter in opening and check it along back wall

8. Scribe and fit back wall if needed

9. Secure counter to lower cabinet

   (NOTE: Counter is generally screwed to the base cabinet from the bottom.)

CABINET AND SHELF INSTALLATION
UNIT III

JOB SHEET #2--INSTALL SHELVES IN A CLOSET

I. Tools and materials

   A. Tools

      1. Framing square

      2. Level

      3. Claw hammer, 13 oz

      4. Tape measure, 12 or 16 ft

      5. Nail set

      6. Scriber

      7. Hand saw, rip

   B. Materials

      1. Shelving

      2. 1 x 4's, shelf supports or battens

      3. Nails, 10d finish

II. Procedure

   A. Measure up from floor to established height of shelf; allow for supports and mark wall in both corners

   B. Mark wall out from corner the width of shelf

   (NOTE: Make sure marks are level.)

   C. Cut long (rear) support and nail to wall with top of mark on wall

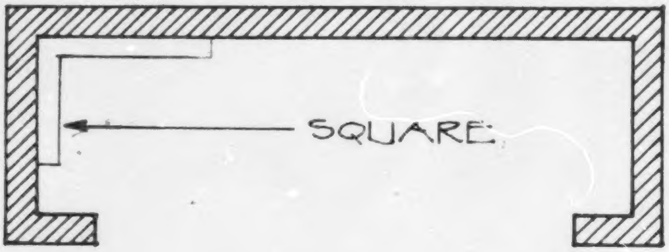
   D. Cut and nail side supports to wall

   E. Again check to be sure supports are level

JOB SHEET #2

F. Use framing square to check corners for square (Figure 1)

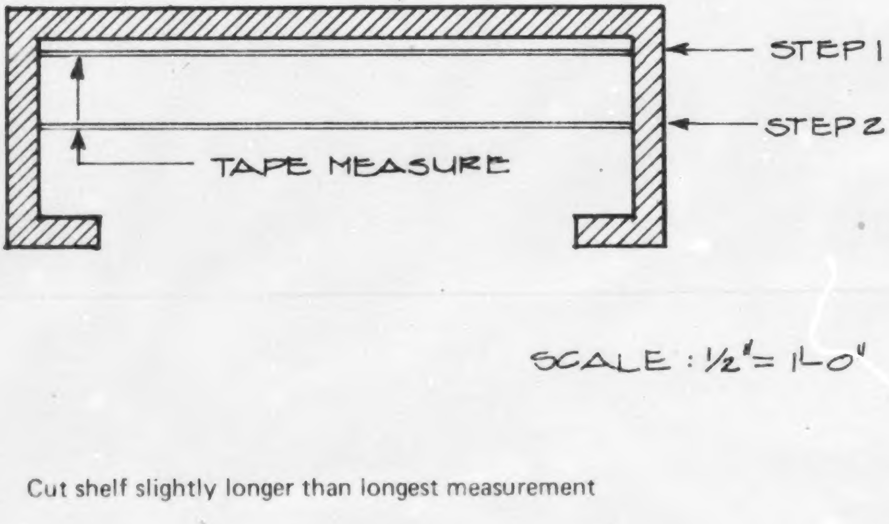
FIGURE 1



SCALE : 1/2" = 1'-0"

G. Check measurements across rear wall (Figure 2, Step 1) and at face of shelf check measurement again (Figure 2, Step 2)

FIGURE 2


STEP 1
STEP 2
TAPE MEASURE

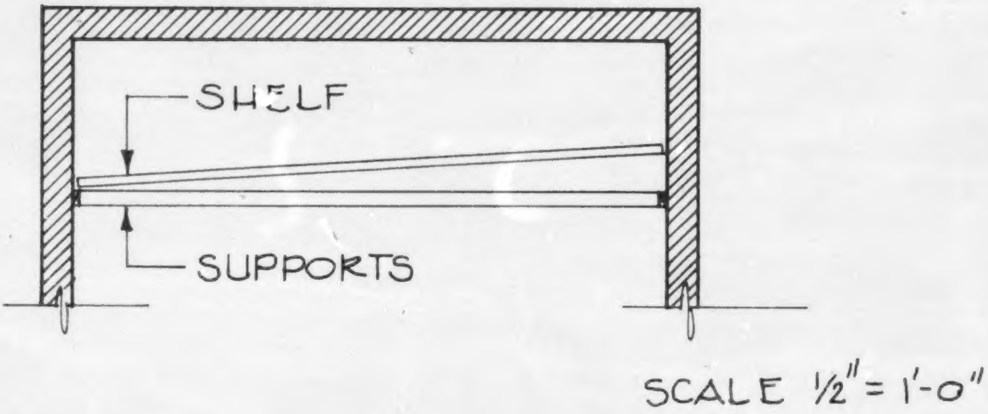
SCALE : 1/2" = 1'-0"

H. Cut shelf slightly longer than longest measurement

JOB SHEET #2

I. Place shelf on supports at left side and lower right side as far as possible (Figure 3)

FIGURE 3



J. Scribe shelf along left side; then remove and cut shelf on this line

K. Recheck measurement across closet at front edge of shelf and transfer this measurement to top of shelf

L. Replace shelf, this time with shelf resting on right support

M. Set scribe to match mark on shelf, then scribe top of shelf

N. Remove and cut shelf along scribed mark

O. Replace shelf and, if necessary, fasten to supports

CABINET AND SHELF INSTALLATION
UNIT III

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______ a. Display and storage units

______ b. Base unit of a cabinet having a working surface

______ c. Those items in building construction that permit movement, are decorative, or are both; includes hinges, catches, pulls, and knobs

______ d. Projection, usually round, for opening doors and drawers

______ e. Hard, laminated plastic material used as a covering for counter tops

______ f. Projecting device in the form of a handle for opening doors and drawers

______ g. Horizontal bar of wood used to separate drawers and doors on the face of a cabinet

______ h. One of the vertical members used to separate drawers and doors on the face of a cabinet and to support the top

______ i. Recessed space at the floor line of a base cabinet or other built-in that permits one to stand close without striking the vertical surface with toes

______ j. Upper portion of a cabinet that is wall hung above the base cabinet

______ k. Underside of any subordinate member of a structure, such as the undersurface of an arch, cornice, or stairway

______ l. Vertical continuation of a counter top at the back and ends

______ m. Tool with a sharp point and a pencil point used to make marks

______ n. Pieces of wood or other material fastened horizontally to a wall to hold objects

1. Knob
2. Pull
3. Stile
4. Wall cabinet
5. Fixtures
6. Soffit
7. Plastic laminate
8. Rail
9. Back splash
10. Counter unit
11. Hardware
12. Toe space
13. Shelves
14. Scriber

1832

2. Identify the following parts of the cabinet pictured below. Place the correct numbers in the blanks provided.

______a. Toe space

______b. Soffit

______c. End panel

______d. Rail

______e. Stile

______f. Shelf support

______g. Shelf

______h. Drawer guide

______i. Drawer

______j. Door

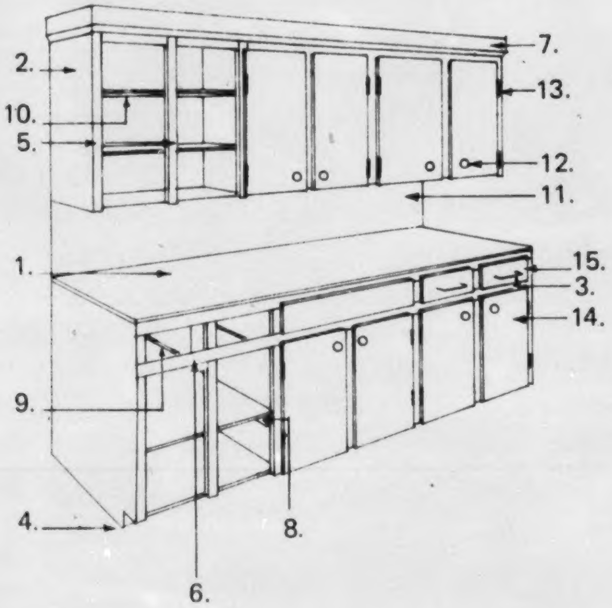
______k. Hinge

______l. Pull

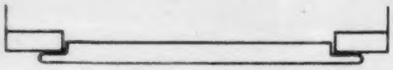
______m. Knob

______n. Counter top

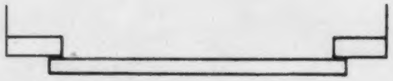
______o. Back splash



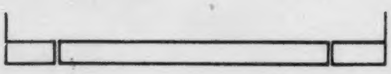
3. Identify types of cabinet door installation by placing the correct names in the blanks provided.



a. ______________________



b. ______________________



c. ______________________

4. Identify the following items of cabinet hardware by writing the correct names in the blanks provided.

a. ______________________

b. ______________________

c. ______________________

d. ______________________

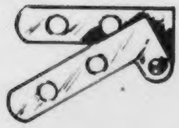
e. ______________________

f. ______________________

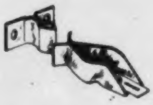
g. ______________________

h. ______________________

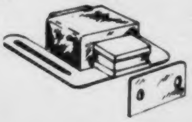
a.



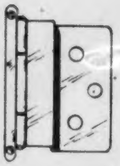
b.



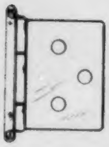
c.

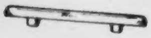


d.



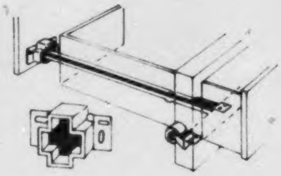
e.



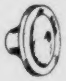


f.

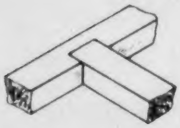
g.

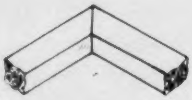


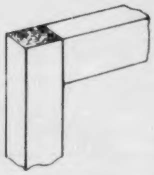
h.



5. Identify joints used in cabinet construction.

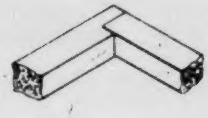




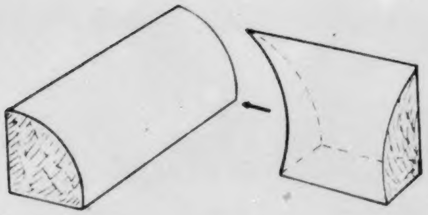


a. ______________ b. ______________ c. ______________

1834



d.



e.

6. Name types of cabinets.

a.

b.

7. Demonstrate the ability to:

a. Install a custom-built cabinet.

b. Install shelves in a closet.

(NOTE: If the above activities have not been accomplished prior to the test, ask your instructor when they should be completed.)

CABINET AND SHELF INSTALLATION
UNIT III

ANSWERS TO TEST

1. a. 5
   b. 10
   c. 11
   d. 1
   e. 7
   f. 2
   g. 8
   h. 3
   i. 12
   j. 4
   k. 6
   l. 9
   m. 14
   n. 13

2. a. 4
   b. 7
   c. 2
   d. 6
   e. 5
   f. 8
   g. 10
   h. 9
   i. 15
   j. 14
   k. 13
   l. 3
   m. 12
   n. 1
   o. 11

3. a. Lipped
   b. Surface
   c. Flush

4. a. Concealed hinge for flush doors
   b. Friction catch
   c. Magnetic catch
   d. Semi-concealed hinge for 3/8" lipped doors

e. Semi-concealed hinge for flush doors

f. Pull

g. Monorail drawer guide

h. Knob

5. a. Dado

b. Miter

c. Butt

d. Rabbet

e. Coped

6. a. Custom-built or mill-built

b. Modular or stock units

7. Performance skills evaluated to the satisfaction of the instructor

PANELING
UNIT IV

UNIT OBJECTIVE

After completion of this unit, the student should be able to name various styles of paneling and methods of fastening paneling to a wall. The student should also be able to identify methods of joint treatment of paneling and estimate material needed to panel a room. This knowledge will be evidenced by completion of the job sheets and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with paneling to the correct definitions.
2. Name styles of paneling.
3. Identify methods of joint treatment of paneling.
4. Name types of wall surface preparation for paneling.
5. Name methods of fastening paneling to a wall.
6. Estimate material needed to panel a room.
7. Demonstrate the ability to:
    a. Install V-grooved paneling directly to studs.
    b. Install prefinished paneling to dry wall using mastic.

PANELING
UNIT IV

SUGGESTED ACTIVITIES

I. Suggested activities for instructor:

   A. Provide students with objective sheet.

   B. Provide students with information and job sheets.

   C. Make transparencies.

   D. Discuss unit and specific objectives.

   E. Discuss information sheet.

   F. Demonstrate and discuss procedures outlined in job sheet.

   G. Give test.

II. Instructional materials:

   A. Objective sheet

   B. Information sheet

   C. Transparency masters

      1. TM 1--Styles of Paneling

      2. TM 2--Styles of Paneling (Continued)

      3. TM 3--Joint Treatment

      4. TM 4--Wall Surface Preparation

   D. Job sheets

      1. Job Sheet #1--Install V-Grooved Paneling Directly to Studs

      2. Job Sheet #2--Install Prefinished Paneling to Dry Wall Using Mastic

   E. Test

   F. Answers to test

III. Unit references:

A. Burke, Arthur E.; Dalzell, J. Ralph; and Townsend, Gilbert. *Architectural and Building Trades Dictionary.* Chicago: American Technical Society, 1955.

B. Durbahn, Walter E., and Sundberg, Elmer W. *Fundamentals of Carpentry.* 3rd ed. Chicago: American Technical Society, 1963.

C. Wagner, Willis H. *Modern Carpentry.* Homewood, Illinois: Goodheart-Willcox, 1969.

D. Masonite Corporation. *Form # 701109.* 29 N. Wacker Drive, Chicago, Illinois 60606.

PANELING
UNIT IV

INFORMATION SHEET

I. Terms and definitions

A. Batten--Narrow strip of board or molding used to cover the cracks between paneling

B. Butt joint--Joint made by fastening two panels together edge to edge without overlapping

C. Chair rail--Wooden molding at chair back height placed horizontally around a room

D. Furring--Strips of lumber placed against one surface for the attachment of another surface

E. Mastic--Substance with high adhesive qualities used to fasten paneling to a wall

F. Open joint--Joint that does not meet but has a gap between the two sheets of paneling to accent the joint

G. V-grooved--Surface decoration applied to paneling, consisting of cutting V-shaped grooves at random spacing longitudinally on the face of paneling

H. Wainscot--Application of paneling only on the lower portion of an interior wall

II. Styles of paneling (Transparencies 1 and 2)

A. V-grooved

B. Plain

C. Brushed

III. Methods of joint treatment (Transparency 3)

A. Butt joint with V-groove

B. Batten strip

C. Open joint

INFORMATION SHEET

IV. Wall surface preparation for paneling (Transparency 4)

- A. Directly to studs
- B. Over sheetrock
- C. Furring strips

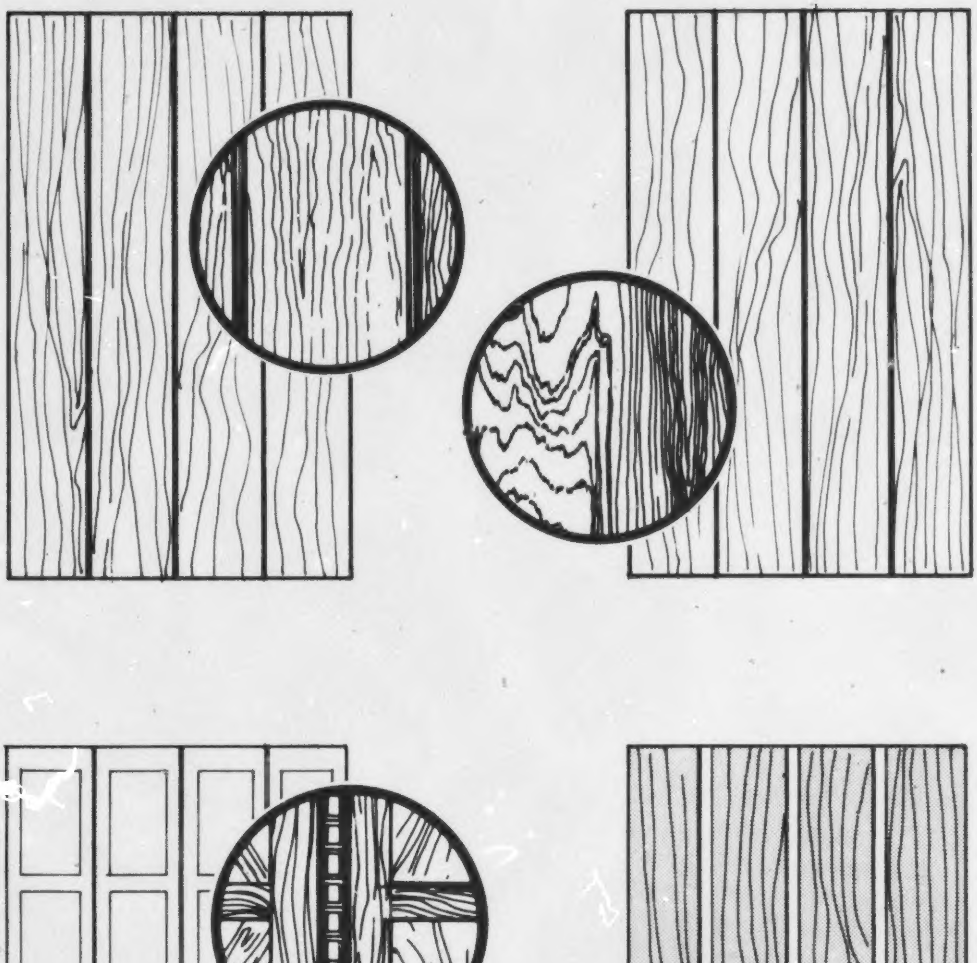
V. Methods of fastening paneling to a wall

- A. Nails
- B. Mastic

VI. Material estimating

- A. Paneling
  1. Determine the number of feet around the perimeter of the room
  2. Determine the number of feet in the partition walls
  3. Divide the total footage by four to get the number of 4' x 8' panels needed
- B. Molding
  1. Count inside corners
  2. Count outside corners
  3. Determine lineal feet of baseboard; allow for cutting
- C. Nails, 3d or 4d finish--Estimate one pound per average room

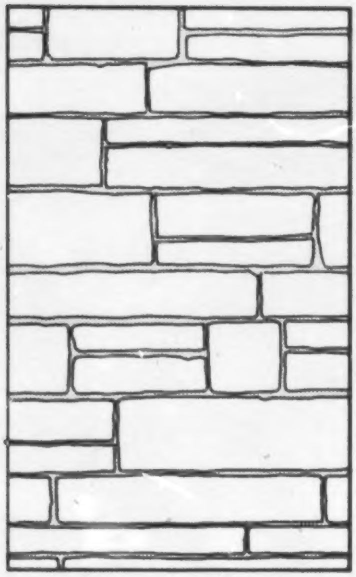
Styles of Paneling

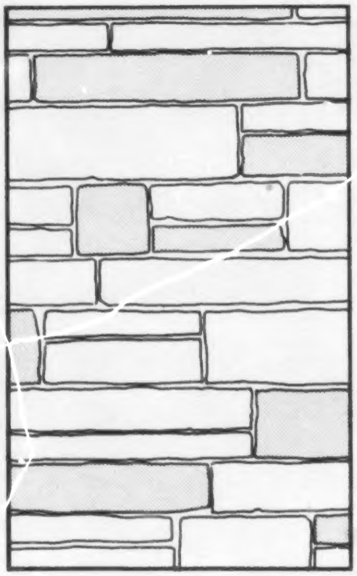


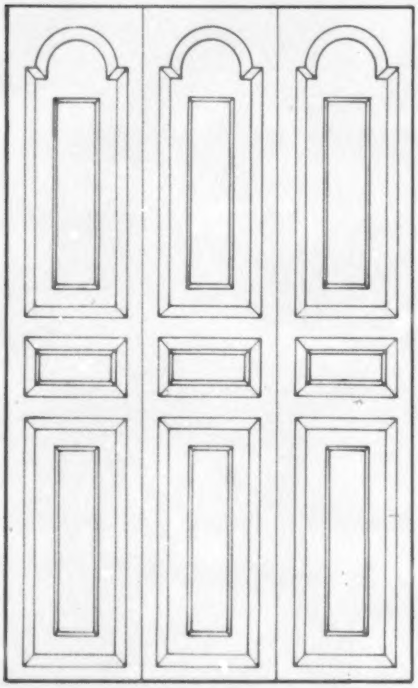
(NOTE: These are only a few of the many styles and patterns of paneling.)

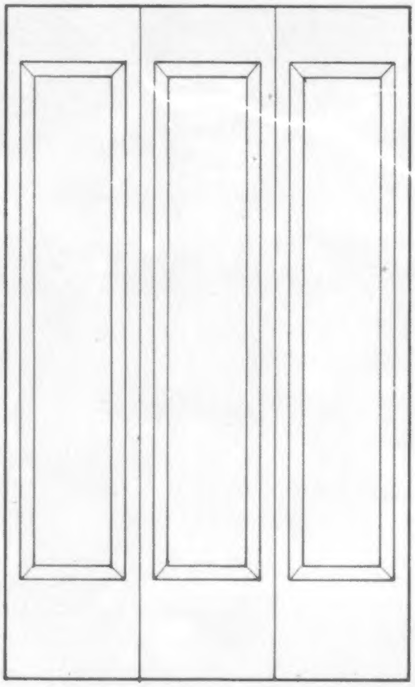
Styles of Paneling

(Continued)



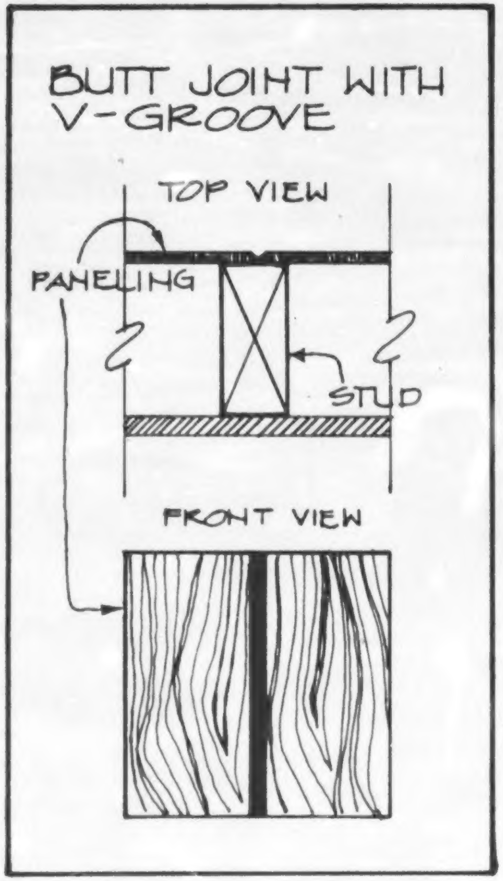


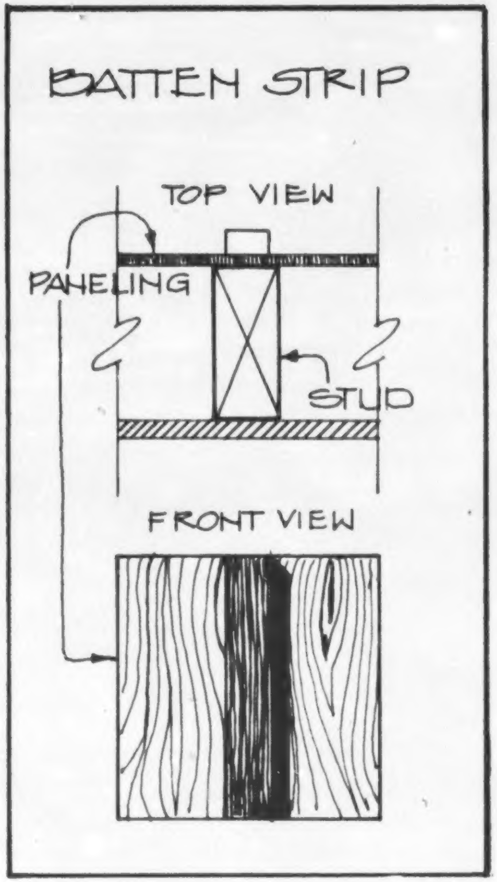


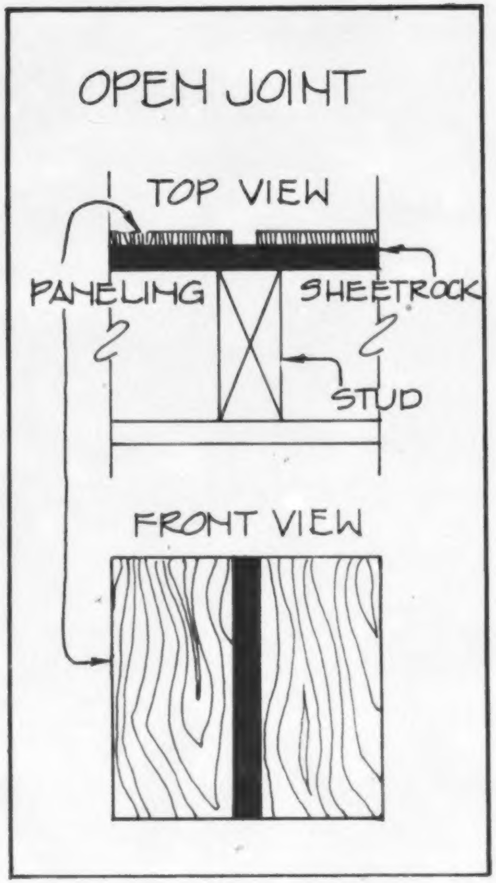


(NOTE: These are only a few of the many styles and patterns of paneling.)

Joint Treatment


BUTT JOINT WITH V-GROOVE
TOP VIEW
PANELING
STUD
FRONT VIEW


BATTEN STRIP
TOP VIEW
PANELING
STUD
FRONT VIEW


OPEN JOINT
TOP VIEW
PANELING
SHEETROCK
STUD
FRONT VIEW

SCALE : 3" = 1'-0"

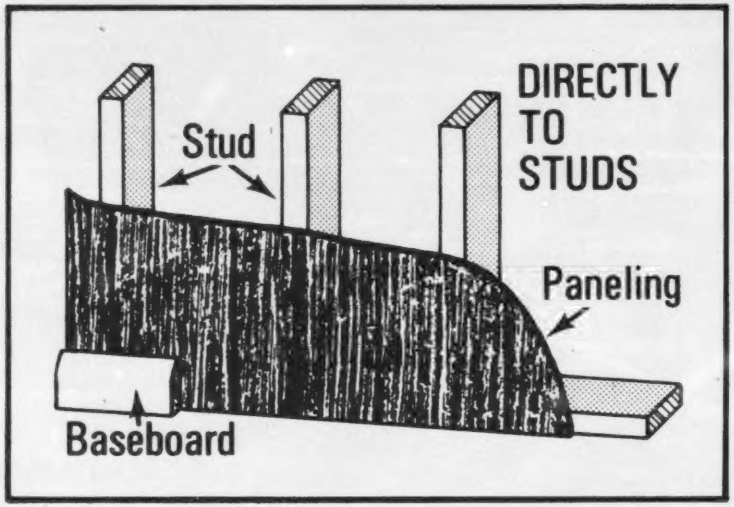
TM 3

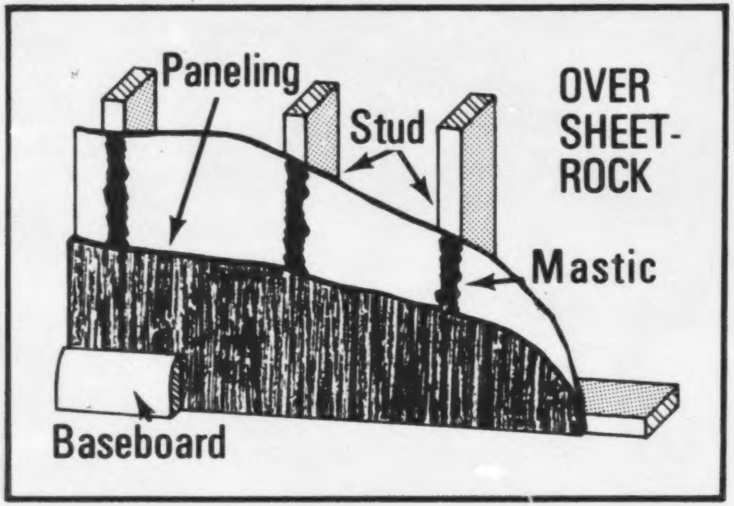
1845

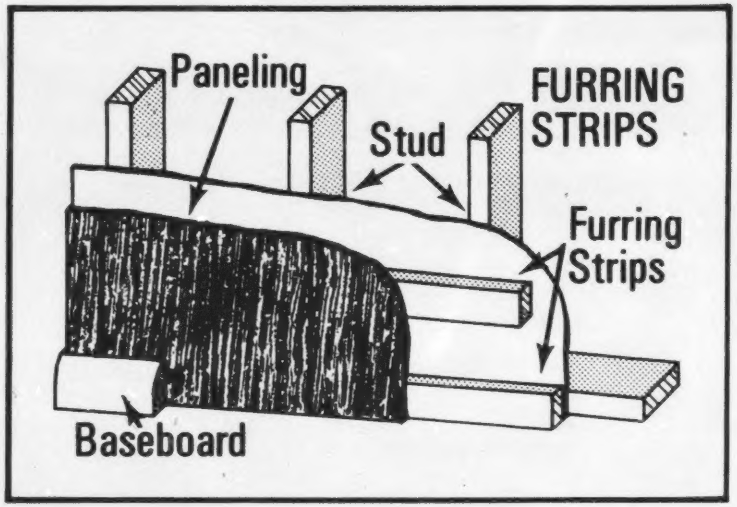
CC · 161-K

1846

Wall Surface Preparation


DIRECTLY TO STUDS
Stud
Paneling
Baseboard


OVER SHEET-ROCK
Paneling
Stud
Mastic
Baseboard


FURRING STRIPS
Paneling
Stud
Furring Strips
Baseboard

TM 4

1847

1848

CC - 163-K

PANELING
UNIT IV

JOB SHEET #1--INSTALL V-GROOVED PANELING DIRECTLY TO STUDS

I. Tools and materials

A. Tools

1. Table saw, radial arm saw, or skill saw
2. Saber saw
3. Block plane
4. Claw hammer, 13 ounce
5. Tape measure, 12 or 16 foot
6. Framing square
7. Scribe
8. Tri-square
9. Level

B. Materials

1. Paneling
2. Inside corners
3. Outside corners
4. Baseboard
5. Nails, 3d or 4d finish

(NOTE: Before starting application be sure paneling has been stored in rooms at least twenty-four hours prior to installation.)

II. Procedure

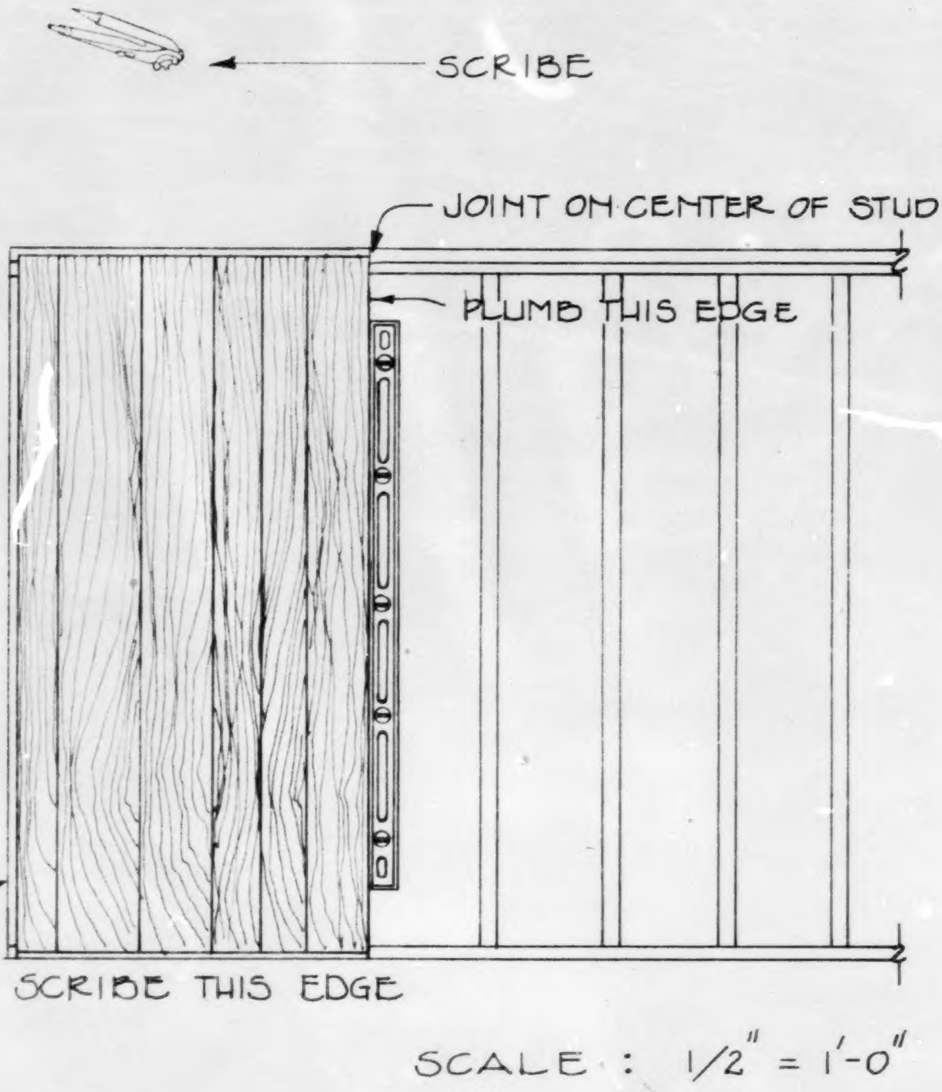
A. Stand the plywood on end around the room and arrange so that adjoining panels match as to grain patterns and color

JOB SHEET #1

B. Begin at an inside corner, plumb the edge of paneling away from the corner, and scribe the opposite edge to fit the corner (Figure 1)

(NOTE: All joints must be made on a stud.)

FIGURE 1


SCRIBE
JOINT ON CENTER OF STUD
PLUMB THIS EDGE
SCRIBE THIS EDGE
SCALE : 1/2" = 1'-0"

C. Align the panels with the sides of door and window openings whenever possible

(NOTE: This procedure helps to cut down on waste.)

JOB SHEET #1

D. Measure accurately and cut out holes for switches and receptacles (Figures 2 and 3)

(NOTE: All measurements should be made from the ceiling and the side.)

FIGURE 2

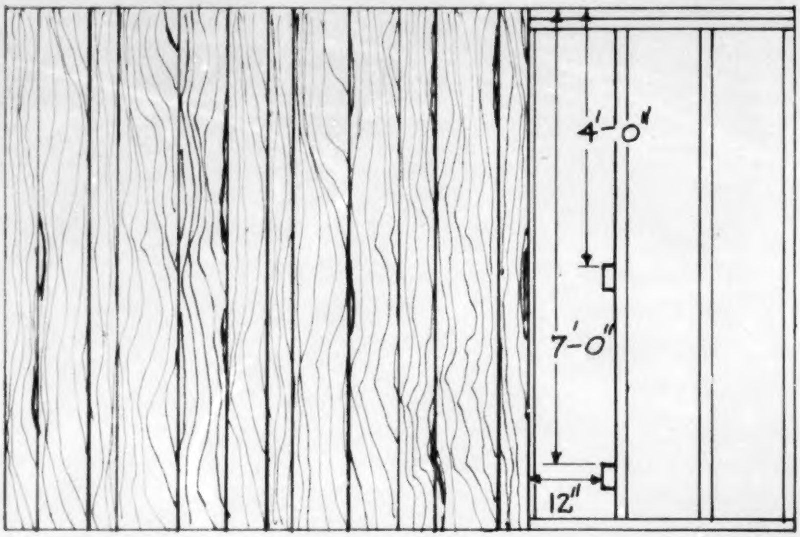
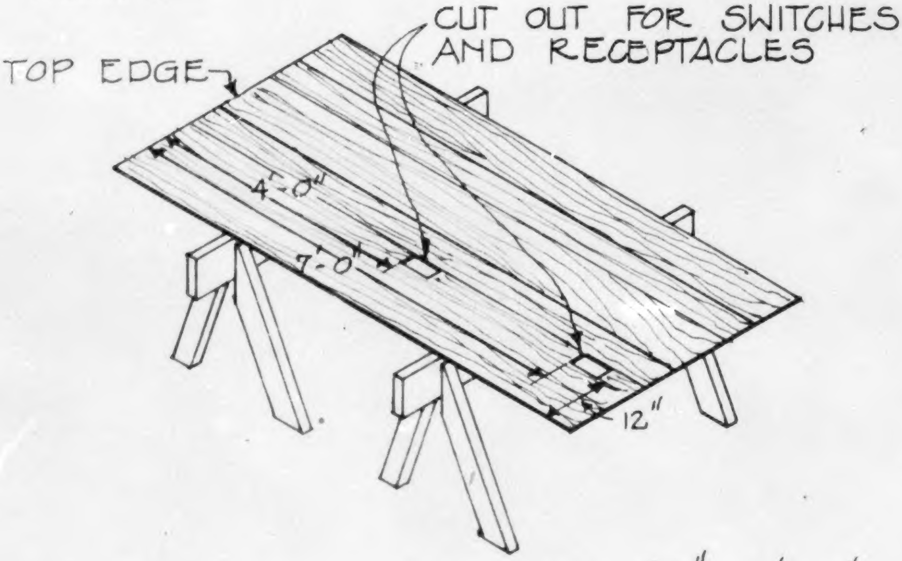


FIGURE 3


CUT OUT FOR SWITCHES AND RECEPTACLES
TOP EDGE
4'-0"
7'-0"
12"

SCALE : 3/8" = 1'-0"

E. Install all of the paneling, working around the room

(NOTE: Nail the paneling on each stud about every sixteen inches using 3d or 4d finish nails. Set the nails after driving almost flush. For prefinished paneling, colored nails may be used, or use 3d or 4d finish nails, set, and then fill with putty stick.)

F. Scribe inside corners to fit or install corner molding after the baseboard is installed

G. Install trim, baseboard, and outside and inside corner molding

(NOTE: Paneling may be returned in the window openings using corner molding or they may be cased out in the conventional manner.)

H. Install all of the paneling, working from one corner back to that corner

(NOTE: Use mastic according to manufacturer's recommendations. For prefinished paneling colored nails may also be used.)

I. Position panel in place and then press tightly against wall after mastic has been applied

(NOTE: If mastic does not hold securely, it may be necessary to place braces against panel to hold in place until mastic holds securely.)

J. Install trim, baseboard, outside corners, and inside corners

(NOTE: Paneling may be returned in the window openings using corner molding or may be cased out in the conventional manner.)

PANELING
UNIT IV

JOB SHEET #2--INSTALL PREFINISHED PANELING TO DRY WALL USING MASTIC

I. Tools and materials

  A. Tools

    1. Table saw, radial arm saw, or skill saw
    2. Saber saw
    3. Block plane
    4. Claw hammer, 13 ounce
    5. Tape measure, 12 or 16 foot
    6. Framing square
    7. Scribe
    8. Tri-square
    9. Caulking gun
    10. Level

  B. Materials

    1. Paneling
    2. Inside corners
    3. Outside corners
    4. Baseboard
    5. Mastic (adhesive)
    6. Nails, 3d or 4d finish
    7. 2 x 4's for braces

    (NOTE: Before starting application be sure paneling has been stored in room at least twenty-four hours prior to application.)

JOB SHEET #2

II. Procedure

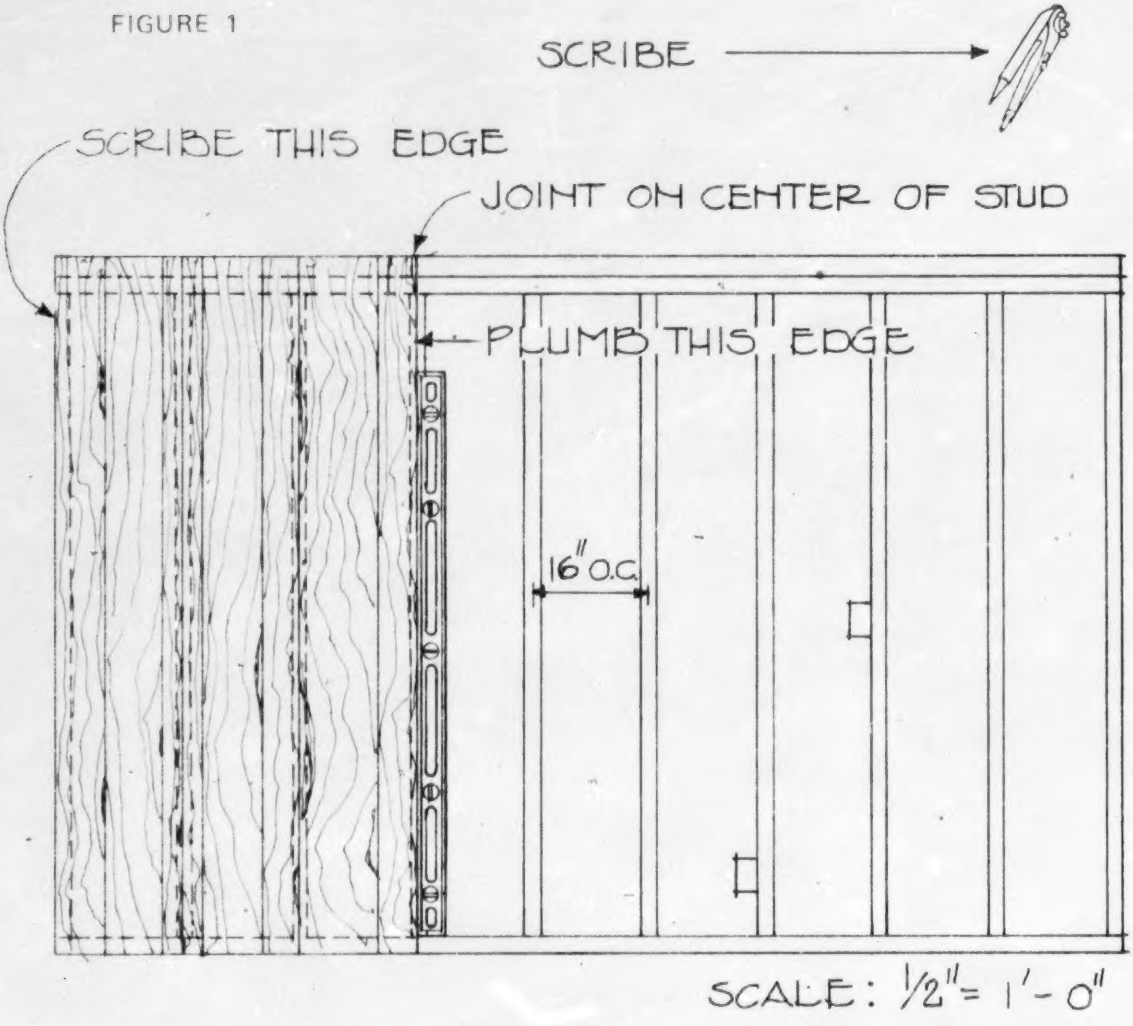
A. Stand plywood on end around the room and arrange so that adjoining panels match as to grain patterns and color

B. Mark panel numbers on back side

C. Begin installation at an inside corner

D. Plumb the edge of paneling away from the corner and, using scribe, mark the edge to fit corner (Figure 1)

FIGURE 1


SCRIBE
SCRIBE THIS EDGE
JOINT ON CENTER OF STUD
PLUMB THIS EDGE
16" O.C.
SCALE: 1/2" = 1'-0"

(NOTE: If corner moldings are used, it may not be necessary to scribe and fit corners.)

JOB SHEET #2

E. Measure accurately and cut out holes for switches and receptacles (Figures 2 and 3)

(NOTE: All measurements should be made from ceiling and the edge of panel.)

FIGURE 2

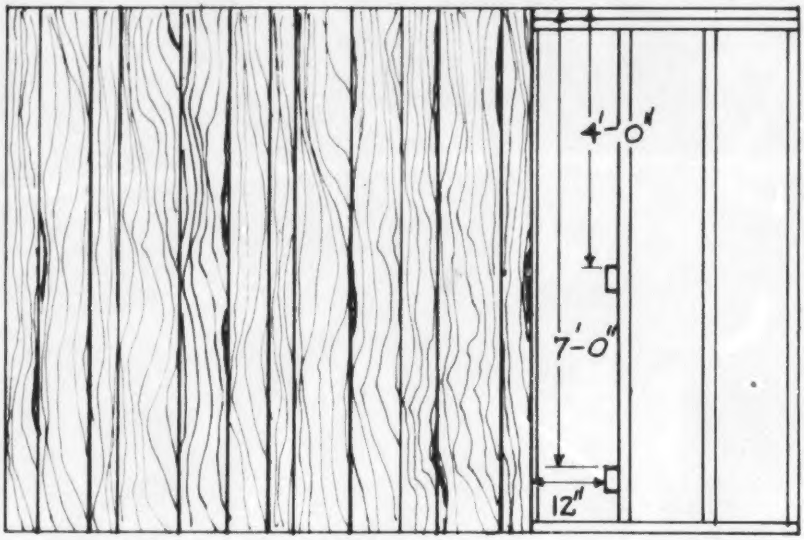
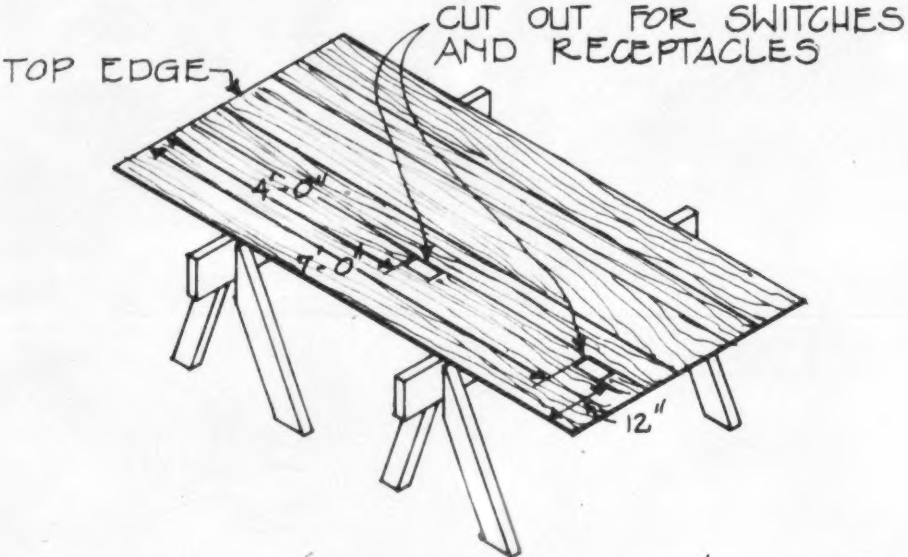


FIGURE 3

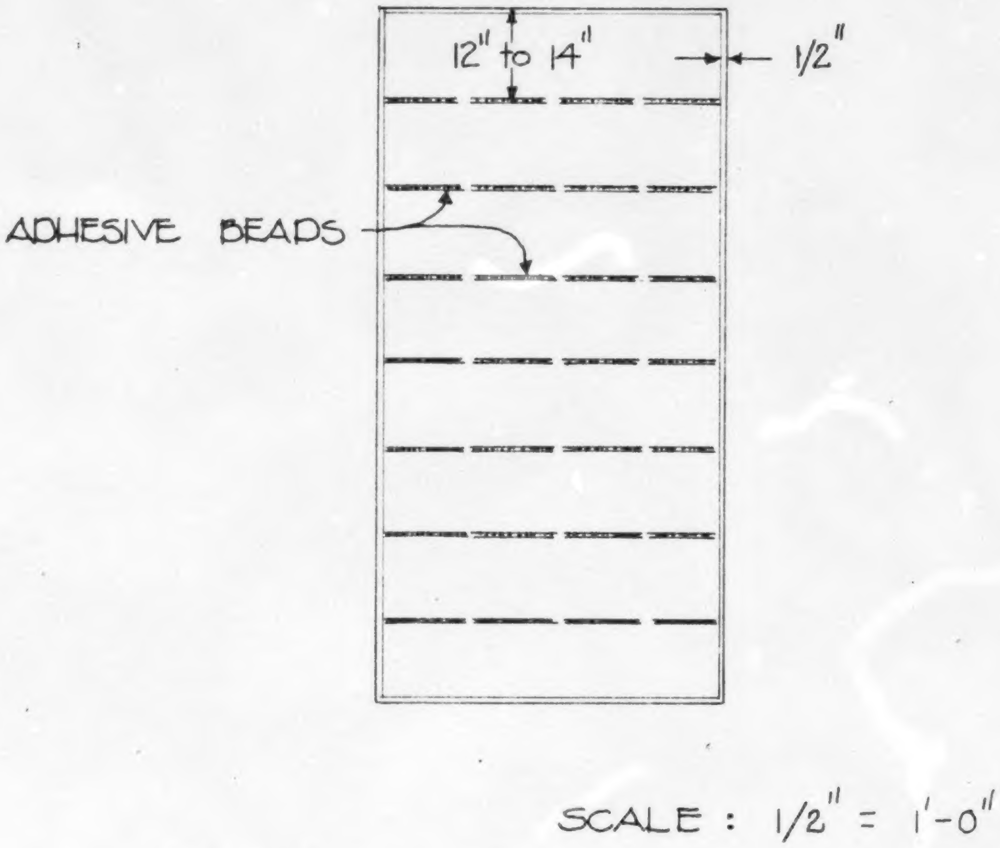

CUT OUT FOR SWITCHES AND RECEPTACLES
TOP EDGE
4'-0"
7'-0"
12"

SCALE : 3/8" = 1'-0"

JOB SHEET #2

F. Apply adhesive to back of panel following manufacturer's recommendations or as in Figure 4

FIGURE 4



1. Apply a continuous bead about 1/2" in from edge

   (NOTE: It is important that this bead is continuous to seal out any moisture.)

2. Apply four beads 6"-8" long and spaced evenly across about every 12"-14"

G. Nail sparingly across top edge

(NOTE: Be sure panel has 1/4" clearance at top and bottom.)

JOB SHEET #2

H. Press panel to wall

I. Pull panel from wall at bottom edge after about 15 minutes, and then press it firmly back into position

(NOTE: This will assure adherence. Align panels with sides of door and window openings whenever possible. This procedure helps cut down on waste.)

PANELING
UNIT IV

TEST

NAME ______________________________ SCORE ______________

1. Match the terms on the right to the correct definitions by placing the appropriate numbers in the blanks provided.

______a. Narrow strip of board or molding used to cover the cracks between paneling

______b. Joint made by fastening two panels together edge to edge without overlapping

______c. Wooden molding at chair back height placed horizontally around a room

______d. Strips of lumber placed against one surface for the attachment of another surface

______e. Substance with high adhesive qualities used to fasten paneling to a wall

______f. Joint that does not meet but has a gap between the two sheets of paneling to accent the joint

______g. Surface decoration applied to paneling, consisting of cutting V-shaped grooves at random spacing longitudinally on the face of paneling

______h. Application of paneling only on the lower portion of an interior wall

1. Furring
2. Batten
3. V-grooved
4. Open joint
5. Butt joint
6. Wainscot
7. Mastic
8. Chair rail

2. Name styles of paneling.

a. ____

b. ____

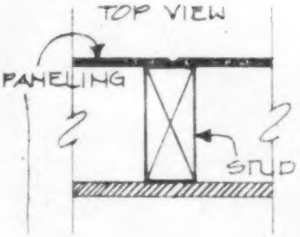
c. ____

3. Identify methods of joint treatment of paneling by placing the appropriate numbers in the blanks provided.

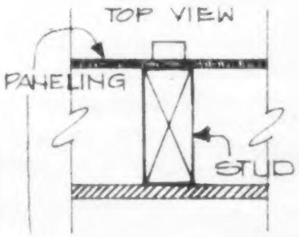
   ______a. Batten strip

   ______b. Butt joint with V-groove

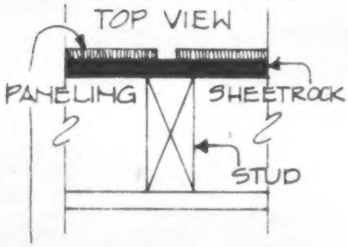
   ______c. Open joint


TOP VIEW
PANELING
STUD

1.


TOP VIEW
PANELING
STUD

2.


TOP VIEW
PANELING
SHEETROCK
STUD

3.

4. Name types of wall surface preparation for paneling.

   a. ____________________

   b. ____________________

   c. ____________________

5. Name methods of fastening paneling to a wall.

   a. ____________________

   b. ____________________

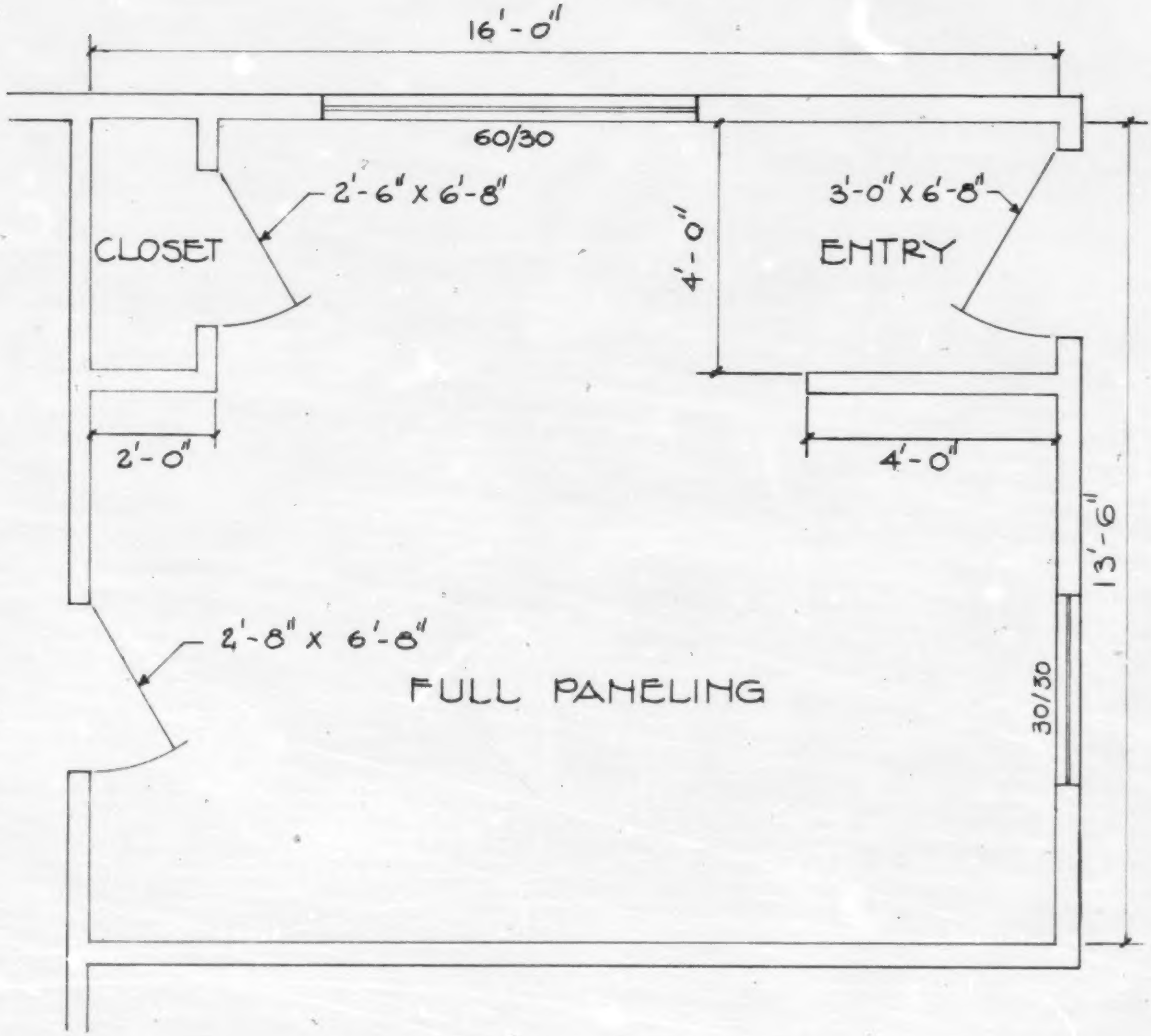
6. Estimate the materials needed to panel the room illustrated on the next page.

   a. 4' x 8' sheets of paneling--____________________

   b. Inside corners 8'--____________________

   c. Outside corners 8'--____________________

   d. Baseboard--____________________


16'-0"
60/30
2'-6" X 6'-8"
CLOSET
4'-0"
3'-0" X 6'-8"
ENTRY
2'-0"
4'-0"
13'-6"
2'-8" X 6'-8"
FULL PANELING
30/30

SCALE : 3/8" = 1'-0"

7. Demonstrate the ablity to:
   a. Install V-grooved paneling directly to studs.
   b. Install prefinished paneling to dry wall using mastic.

(NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

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PANELING
UNIT IV

ANSWERS TO TEST

1. a. 2
   b. 5
   c. 8
   d. 1
   e. 7
   f. 4
   g. 3
   h. 6
2. a. V-grooved
   b. Plain
   c. Brushed
3. a. 2
   b. 1
   c. 3
4. a. Directly to studs
   b. Over sheetrock
   c. Furring strips
5. a. Nails
   b. Mastic
6. a. 17
   b. 7
   c. 3
   d. 60'
7. Performance skills evaluated to the satisfaction of the instructor

COMMERCIAL CARPENTRY
PROGRESS CHART

Section K
Interior Trim

Job	UNIT I STAIR CONSTRUCTION			UNIT II DOOR HANGING AND TRIM						UNIT III CABINET AND SHELF INSTALLATION					UNIT IV PANELING					
	1	2	3	1	2	3	4	5	6	1	2	3	4	5	1	2	3	4	5	6
Student's Name	UNIT TEST	Material Estimating	Lay Out, Cut, & Assemble Housed Stair	UNIT TEST	Material Estimating	Install Interior Door Frame, Hang Door, Lock, & Trim	Case Window	Case Door Frame	Install Prehung Door Unit	UNIT TEST	Install Custom-Built Cabinet	Install Shelves in a Closet			UNIT TEST	Install V-Grooved Paneling Directly to Studs	Install Prefinished Paneling to Dry Wall Using Mastic			
1																				
2																				
3																				
4																				
5																				
6																				
7																				

Accuracy

	85% Correct	To Satisfaction of Instructor	± 1/8" on Layout Treads & Risers Fit Tightly at Points of Contact	85% Correct	To Satisfaction of Instructor	Square & Plumb with All Joints Tight	Square & Plumb with All Joints Tight	Square & Plumb with All Joints Tight	Square & Plumb with All Joints Tight	85% Correct	Within 1/8" of Level & Plumb Within 1/16" of Fit on Scribe	Within 1/16" of Fit on Scribe			85% Correct	All Joints Tight Within 1/16" of Plumb on 8' Height	All Joints Tight Within 1/16" of Plumb on 8' Height			
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
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